Australian Model Engineering

November-December 1995

Issue 63

$4.85*

LOCOMOTIVES, TRACTION & STATIONARY ENGINES, BOATS, WORKSHOP, PRODUCTS, CLUB NEWS & EVENTS, REVIEWS

In This Issue:
- ☑ Railway Signalling for Live Steamers
- ☑ *Charlie* - A 2" scale Traction Engine
- ☑ A Maryborough Odyssey

9 770819 473005 06

Print Post Approved. Publication No. PP228582/00001 * Recommended Retail Price

Australian Model Engineering

ISSN-0819-4734

Publisher: Australian Model Engineering Pty Ltd.

ACN 008 627 825

Australian Model Engineering is published six times per year at two-monthly intervals. January is the first issue for the year.

Subscriptions

An annual subscription to AME costs just $27 within Australia. NZ is AUD$35; all other countries, AUD$45 surface or AUD$50 air. You can pay by cheque, money order, or overseas bank draft. You can also use your Bankcard, MasterCard or VISA credit card.

All mail (except AME Retail) to:

PO Box 136, ROBERTSON, NSW, 2577, AUSTRALIA

Phone/Fax : (048) 85 1179 or + 61 48 85 1179 from overseas

Printing and Distribution

Printer: Riverina Newspapers (Griffith) Pty Ltd, Ulong Street, Griffith NSW 2680 for the publisher.

Australia Post Print Post Approved.

Publication No. **PP228582/00001**

Distribution is by subscription, through hobby supply houses and related-interest sales outlets, and by Gordon and Gotch Limited to newsagents in Australia and New Zealand.

ADVERTISING DEADLINE

Please have your space for **January-February 1996** issue booked by:

Friday 3 November 1995

Contents

The Cover

As the sun sets on 1995, Graham Kirkby's 2401, a 4-6-2 pacific type locomotive, patiently waits at a red signal on the Windy Ridge Railway. A working signalling system adds safety and realism to any model railway. See how you can do it in the story on page 27.

Photo: Neil Graham

Australian Model Engineering

Crew

Managing Editor
Brian Carter .....(02) 649-5301
Bus. Hrs. (mobile).018 022209
Fax (24 hrs).....(02) 646-1362
email:
carterb@mackie.edfac.usyd.edu.au

Contributing Editors
Leigh Adams, Melanie Dennis, Neil Graham, Dave Harper, Clive Huggan

Asstistant Editing
Tony di Salvo, Murdoch Finlay, Alan Holswich, Trevor Jones, John Oliver, Kris Siderov, Paul Trevaskis

Draughters
Dave Adams, Ian Flower, Ken Gifford, Rod Heslehurst, Peter Kerville, Peter Manning, Greg Young

Keyboards
Susanne Carter, Phyl Oliver, Trish Thompson

Contributors
Bruce Allen, Warwick Allison, Doug Baxter, Peter Dawes, Ross Edmondson, John Gibson, Barry Glover, Peter Lukey, Bob White

Subscriptions & Back Issues
Robert Fox .....(042) 56-5013

Publication Manager
Neil Graham.....(048) 85-1179

Area Representatives
Western Australia
Doug Baker.....(09) 341-1630
Keith Watson .....(09) 457-2008

South Australia
Andrew Matthews .....(08) 384-5726

Victoria
Bill Belton .....(054) 28-7015
Bill Taylor .....(03) 9458-3404

Tasmania
Don Bateson .....(004) 35-7524

ACT
Gerardus Mol .....(06) 258-1797

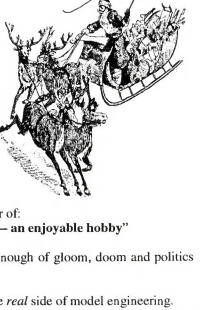
New South Wales
Jim Auld.....(047) 39-2904
Barry Glover .....(042) 84-0294

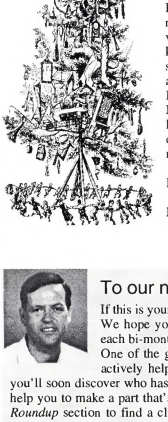
Queensland
Dave Harper.....(07) 3261-1140

New Zealand
Murray Lane .....(09) 534-8396

Comment

To all our readers:
Merry Christmas
and a
Happy New Year
from the AME Crew





1996 should be the year of:
"Model Engineering — an enjoyable hobby"

I think we've all had enough of gloom, doom and politics for one year!

Now it's time to see the *real* side of model engineering.
I'm prepared to open this Comment section of AME for the next six issues to any model engineer willing to share their visions of "enjoyment with model engineering". We all know it is the kind of past time that promotes all kinds of skills as well as those relaxing (and sometimes hectic) days at the throttle. Let's hear your story...
I'll need the first submission — for January, by 10 November so get cracking! 400 (min) to 600 (max) words limit, I'll select the submissions that best portrays the spirit of model engineering as the "enjoyable hobby" that it really is.

Have a *grate* Christmas!

Full steam ahead for 1996!

Brian Carter

To our new reader

If this is your first issue of Australian Model Engineering, welcome!
We hope you'll look forward to the ideas, news and camaraderie in each bi-monthly issue.
One of the great things about our hobby is the way model engineers actively help each other. Unless you live in an isolated community, you'll soon discover who has valuable experience in your field of interest, or who will help you to make a part that's too big for your workshop machinery. Look in the *Club Roundup* section to find a club that's near to you; pay a visit and you'll usually find model engineers who live not too far away. Then you can experience the great fellowship that makes our hobby special.
This magazine is prepared in the same spirit of "model engineers helping each other". About two dozen people put many hundreds of hours work into each issue — all on a voluntary basis — to help model engineers in Australia and New Zealand keep up to date and stay in touch.
We rely on our readers to write articles for us — for the same (non-existent) rate of pay! If you have ideas or techniques that you feel would be interesting to others, please drop us a line. We'll gladly help with preparation of artwork or editing if that's necessary. Most important of all, please support the people who advertise in our magazine. Without them to pay the bills, you wouldn't be reading this!

Brian Carter

Expo 96

Otago Model Engineering Expo 1996

Winston Darling **UNITED TRAVEL**

138 Princes Street. PO Box 287, Dunedin, New Zealand.
Phone: 0011+ 64 + 3 + 477 0449 Fax: 0011+ 64 + 3 + 477 0577 (from Australia)

Come to New Zealand...

Sydney and Melbourne travellers could travel to Brisbane by rail or coach at additional cost, to reduce overall travel cost.

Expo Convenor
Otago Model Engineering Society
PO Box 2163, Dunedin, New Zealand.
Phone: 0011+64+3+488 2766

Suggested itinerary — Sydney Passengers

Sat	30 Dec	Sydney/Hamilton - Kiwi International Airlines
	30/31 Dec	Glenview Motor Hotel - Hamilton (room only)
Sun	31 Dec	Hamilton/Wellington - Overlander Rail
Mon	1 Jan	Wellington/Dunedin - Ansett New Zealand
	1/11 Jan	Dunedin

Suggested itinerary — Brisbane Passengers

Mon	1 Jan	Brisbane/Dunedin - Kiwi International Airlines
	1/11 Jan	Dunedin

Tue	2 Jan	2 Day Excursion Dunedin/Taieri Gorge/Queenstown Transfer pax from accommodation to Dunedin Railway Station. Travel by Taieri Gorge Limited via Taieri Gorge to Middlemarch, re-board coach and travel to Ranfurly, lunch at Ranfurly Lion Hotel, after dinner travel via Alexandra and the Clyde dam to Queenstown dinner at the Remarkable Hotel Resort. Overnight accommodation at Remarkable Resort Hotel, Frankton.
Wed	3 Jan	Queenstown/TSS Earnslaw/Walter Peak Station/Kingston Flyer/Dunedin Breakfast - Remarkable Hotel Resort, transfer to TSS Earnslaw for visit to Walter Peak Station and return, lunch - Gourmet Express, free time in Queenstown after lunch, transfer late afternoon to Kingston for a trip on the Kingston Flyer, travel to Gore, dinner - Croydon Lodge, return to Dunedin after dinner.
Thurs	4 Jan	Registration Day (convention)
	4/11 Jan	Convention
Thurs	11 Jan	Dunedin/Christchurch - Southerner Rail
	11/14 Jan	Riccarton Motor Inn - Bed & Breakfast (Cooked)
Fri	12 Jan	Tranzalpine Express Rail Day Excursion
	13/14 Jan	At leisure

This section is common to both Sydney and Brisbane departures

Mon	15 Jan	Christchurch/Picton - Coastal Pacific Rail Picton/Wellington - Interislander Ferry Sharella Motor Inn (Room only)
Tue	16 Jan	Wellington/Hamilton - Overlander Rail
	16/17 Jan	Glenview Motor Hotel (Room only)
Wed	17 Jan	Hamilton/Sydney - Kiwi International Airlines

Interim costing from Sydney is NZ$1792.00 per person on a share twin basis. The above cost is subject to currency fluctuations and confirmation of final passenger numbers.

Mon	15 Jan	Christchurch/Dunedin - Southerner Rail
Mon	15 Jan	Dunedin/Brisbane - Kiwi International Airlines

Interim costing from Brisbane is NZ$1389.00 per person on a share twin basis. The above cost is subject to currency fluctuations and confirmation of final passenger numbers.
Both costs do not include: Transfers throughout, Dunedin accommodation, Expo registration or Expo dinner

GREAT HOLIDAY READING

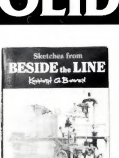
Sketches from BESIDE the LINE

by Kenneth G. Bowen

130 pages, 290 x 230mm

Mostly B&W sketches & some full-colour reproductions. The lineside structures of yesteryear are faithfully and minutely detailed in this collection of everything from water columns to wheat silos, from ganger's huts to signal gantries.

Priced at $44.95



38

by John B Thompson

276 pages, 285 x 215mm, Hard cover, over 40 full-colour photos, profusely illustrated in B&W.

This is *the* book on the famed NSWGR C-38 class 4-6-2s. Covers the initial moves to produce a new express passenger locomotive, the development of the design and the production of the locomotives.

Contains photographs never before published. Some of the locomotives' more memorable fast runs are re-lived.

Priced at $59.95

Standards in Steam — The 50 Class

by R.G. Preston

246 pages, 280 x 215mm, B&W illustrated.

The history of the T or 50 class locomotives of the NSWGR. Covers the design, acquisition, career, modifications, goods traffic & plans.

$39.95 (soft cover), **$44.95** (hard cover)

THE OVERLAND RAILWAY

by W.H. Callaghan

320 pages, 305 x 220mm,

Hard cover, B&W illustrations with 4 colour plates.

This is the history of South Australia's south line from its conception to the near present day. Details the politics, construction, the engineering, safeworking, the rise and decline of traffic and the gradual closure of the branches and eventual takeover by Australian National.

The evolution of motive power and rolling stock are discussed in detail.

Priced at 59.95

BYWAYS OF STEAM — 4

132 pages, 250 x 180mm,

many illustrations and B&W photos.

Features NSW South Coast in steam, centred around Thirroul, Wollongong to Moss Vale; Beecroft Bank workings with 35 class highlighted; life of an engineman Part 4 — Bruce Griffey concludes his interesting story with many anecdotes; South Maitland Railways circa 1930.

Priced at $25.95

BYWAYS OF STEAM — 5

120 pages, 250 x 180mm, B&W photos

Features five photo essays complemented with diagrams and illustrations: To Coonabarabran & return — behind steam with Ian Wallace; Trials and Tribulations of a Railwayman (44yrs on the Railways) with George Goddard; Nambucca in the late 1950's with Fred Saxon and steam was still king of the goods train; 1965 — Last days of steam in Dubbo; The ASM — Wal Jenkins career of 42 years from his railway family youth to start of duties.

Priced at $25.95

BYWAYS OF STEAM — 6

108 pages, 250 x 180mm,

B&W photos with a 4 page colour inclusion.

Features: Wal Jenkins the ASM — learning the job; The death of H.J. Heffernan — the introduction of respirators and the areas they were used; Workings at Sydney station — Fred Saxon takes the reader back to his early days on the railways. This started in the Blue Mountains , he then covers workings at Sydney Central which in those days was all steam; Byways of Steam — 6 also looks at two of our rail heritages, namely Arncliffe Cutting and Knapsack; a brief coverage of Carcour, on the Harden - Blayney cross-country line, this essay is illustrated with diagrams and photographs.

Price: $27.00

ALSO AVAILABLE

Byways of Steam - 7	$27.00
Byways of Steam - 8	$27.00
Byways of Steam - 9	$27.00
Byways of Steam - 10 **(NEW)**	$30.00
Australian Diesel Scene 2	$27.00
Remember When	$59.95
Lines to the Lachlan	$39.95
The 60 class (NSWGR Garratt)	$44.95
Miniature Live Steam in Australia (A5)	$ 9.95

AME VIDEO

24 Hours of Live Steam	$24.95

JUST RELEASED!

FOUR DECADES OF RAILWAY PHOTOGRAPHY

The Fred Saxon Collection

Compiled by noted author, Ian Wallace, this 96 page, hard cover book features railway action in NSW from the 1950s to 1980s.

Most of the photographs have never been published before! The illustrations, which include twenty pages of colour, have been selected from Fred's extensive selection. Included are rare views of vanished locomotives, equipment and operations — remember the suburban pick-up goods? Plus lots more!

The five chapters titles are: Western Division, Sydney Yard and Station, Northern Division, Metropolitan Sydney and Southern Division.

Priced at $38.00

All Prices include Pack & Post Australia wide.

Payment by Cheque, M.O., Bankcard, VISA or MasterCard to:

AME Retail
PO Box 355
Kooringal, NSW, 2650

IDEAL CHRISTMAS GIFTS

Charlie

A 2" Scale Durham and North Yorkshire Agricultural Traction Engine

by John Gibson

Photos by John Gibson unless otherwise noted

The big question on my mind in early 1981 was, what model should I build? I wanted to build a scale steam model of some kind — a boat, locomotive or road locomotive. I finally decided to build the Durham and North Yorkshire (DNY) Agricultural Traction Engine by John Haining — published in *Model Engineer* between 1978 and 1982. The ability to drive the engine without the need for rails, or a pond, was a particular advantage. The Haining model was well proportioned and not too complex.

The prototype

The prototype traction engine was built by one of the smaller cultivating firms — the Durham and North Yorkshire Steam Cultivation Company Ltd — working in the fertile countryside around Ripon and the lower Dales. Their repair shop, the North Bridge Engine Works in Ripon, turned out five engines between about 1873 and 1883 using their spare capacity. John Haining, in his series, described the Durham and North Yorkshire Steam Cultivation Company's number two engine, built in 1875, which was supplied to Mr Welch in Laverick Hall, UK.

This engine is typical of the period, with a long plain-topped chimney, a very short smokebox and plain bunker. The cylinder, 209.5mm (8¼") bore x 254mm (10") stroke, is mounted well forward on the boiler with the slide valve on the nearside. The hornplates were separate plates bolted to planed lengths of angle iron that were riveted to the backhead and throatplate and joined at the top by two crossplates to form a rigid box. The front wheels were 1066.8mm (3ft. 6") diameter by 254mm (10") wide, with the rear wheels 1676.4mm (5ft. 6") by 406.4mm (16") wide, shod with steel strakes. The drive train was a three shaft, two speed layout, with the crankshaft turning forward in forward gear.

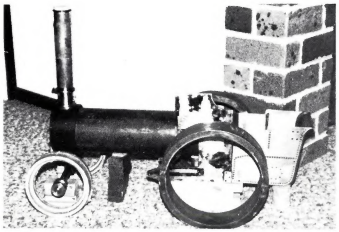
John's Durham and North Yorkshire Agricultural Traction Engine resplendent in its new coat of green and red paint.

Photo: Brian Carter

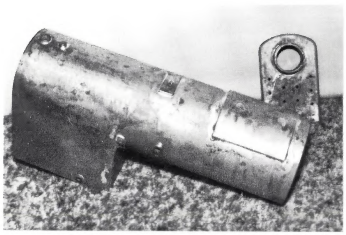
The front wheel rims (right) were cast in aluminium but were never used. They were replaced with steel rims machined from thick-walled steel tube (left).

The model begins

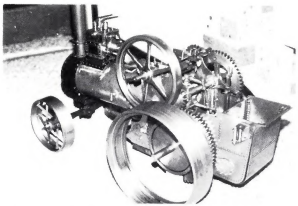
In1981, I drew a set of plans for a copper boiler with preliminary modifications made according to the AMBSC code of the time. By 1983 I had changed the design with an increased number of firebox stays — 42 to 62 — and changes to the throatplate, all different from the published Haining design. I removed the two crown girder stays and replaced them with twenty rod stays. The three longitudinal stays were increased to four. Planning, construction and initial certification of the boiler was carried out under the careful supervision of Jim Hyde and the late Cecil Gunning (both of Sydney Live Steam Locomotive Society). Some of the boiler plates were machine pressed, while others were produced on hardwood timber formers. The boiler was assembled progressively using silver solder, and heated over a firebrick hearth. The heat source was two gas/compressed air burners. The hy-



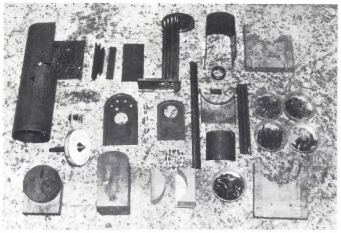
The earliest construction centred on the front-end — the perch bracket, smokebox, and chimney. This was followed by the tender. This assembly mockup was in 1983.



The boiler shell taking shape. The tubes and stays have yet to be fitted. Note the cylinder mounting pad near the front of the shell.



By 1989 the engine is taking shape. Another assembly mockup to see how things are working out.

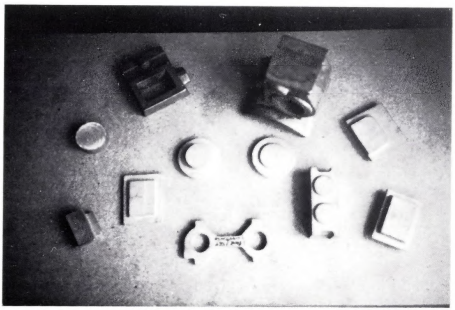


The boiler components! There doesn't seem that many when the boiler is assembled.

drostatic test was carried out in October 1984, but the final steam test was not done until the engine was almost complete in 1993!

Raw materials

Castings purchased from the UK included the cylinder, valve chest and flywheel in cast iron. The cylinder covers, eccentrics and main bearings were supplied in gunmetal. Timber patterns were made for the front wheel rims, compensator housing, compensator bevel gears, and the intermediate drive gears. The front wheel rims were cast in aluminium but were never used. I eventually decided to replace them with steel rims machined from thick-walled steel tube, as I considered the aluminium too soft for the task. In hindsight I am sure that this was the right decision as the steel wheels are already showing some wear. The other items were cast in grey iron at a local foundry and all were machined according to requirements.



Castings purchased from the UK included the cylinder, valve chest, and flywheel in cast iron. The cylinder covers, eccentrics and main bearings were supplied in gunmetal.

Aside from the boiler, the earliest construction centred on the front end — the perch bracket, smokebox and chimney. This was followed by the tender. The hornplates, main bearings and cylinder were next in line for manufacture.

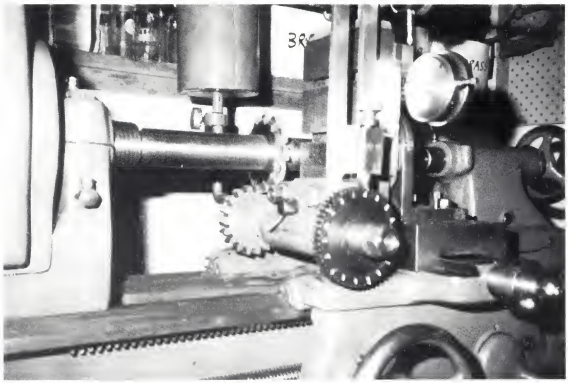
The cylinder

The cylinder was certainly a very big challenge: it represents many hours of pains-taking work. The cylinder casting was cleaned up and marked out, then mounted — upside down — on a boring table in the lathe. A boring bar was set between centres to machine the curved boiler mounting surface. A jig, half-boiler shape, was then mounted on to the boring table and the cylinder bolted to it — this time the correct way up. This allowed the cylinder bore to be machined parallel to the mounting face. The whole assembly was then transferred to the mill table to machine the valve and the regulator surfaces. Drilling and

tapping of the stud holes for the valve and regulator covers was also completed at this time. Separate jigs were used to position the casting to allow drilling and tapping for the cylinder cover studs and for drilling the saddle mounting bolt holes. All machining up to this stage was carried out on a Hercus 230mm (9") swing bench lathe and a DM 25 drill-mill.

The drive train

The drive-gear train was next, and this was completed, together with the wheel rims, by 1989. All castings for the gears in the drive train were each machined on the Hercus lathe, but due to a lack of facilities at home the large diameter spur gears were generated on an industrial universal milling machine using involute gear cutters.



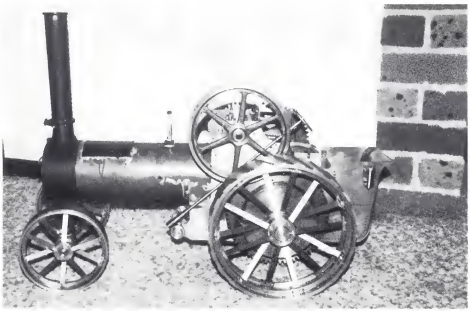
The three small gears in the drive train, and the two pump gears were cut using the Hercus lathe as a milling machine. The gear teeth were cut by advancing the cross-feed under the cutter, and tooth depth was adjusted with the vertical slide feed screw.

Gear cutting in the lathe

The three small gears in the drive train and the two pump gears were cut utilizing the Hercus lathe as a milling machine. The small drive-train gears were made from commercial continuous cast iron bar, which is extremely fine grained and beautiful to machine. The pump gears were made from steel shafting.

Some detail on the set-up used to cut the gears in the lathe may be helpful. The normal lathe cross-slide/compound rest was removed and replaced with a tee slotted cross-slide (boring table). A vertical slide was mounted on the cross-slide in the tee-slots closest to the feed handle. The vertical slide, facing the headstock, was then "clocked" normal to the lathe axis in both the horizontal and vertical planes. A small dividing head was then bolted to the vertical slide with its axis normal to, and below, the lathe axis. The machined gear blank was then fixed to the dividing head, under the lathe axis, and the relevant dividing plate was fixed to the other end of the dividing head shaft. In my case, lathe change gears were used as dividing plates. The dividing plate detent was then fixed in place to engage the teeth in the gear to be used as the dividing plate.

The correct involute gear cutter was fixed to an arbor located between the spindle and a tailstock centre. A drawbar was used to hold the morse taper in place and to ensure positive spindle drive. Cutting depth was monitored throughout the process with two dial indicators mounted above the vertical slide. The gear teeth were cut by advancing the cross-feed (and hence the gear blank) under the cutter, and tooth depth was adjusted with the vertical slide feed screw. Several cuts were taken around the blank in turn to achieve the final tooth depth. The largest gear machined by this method was 63.5mm (2½") OD, 18 teeth, 8DP in grey cast iron. It should be noted that, with great care, larger diameter gears can be cut by the same process, but with the dividing head mounted above the lathe axis if the tooth profile is a bit finer.



***Charlie** taking shape in 1990*

The big wheels

The rear wheel rim blanks were produced by some very friendly blacksmiths at Mt Druitt TAFE. Unable to get thick-walled tube of a suitable diameter, two lengths of steel bar were hot rolled into semicircles, and were then cut to the half circumference length and arc-welded in multiple passes to produce the rim blank. The rear wheel rims were beyond my own lathe capacity and they were machined at a friend's place. The machining of the rims went quite well, but some trouble was experienced in a few hard spots near the welds. In hindsight it would have been desir-

able to have the rims normalized prior to machining but we can be thankful for tungsten carbide cutters — can't we!

The spokes and strakes were cut from mild steel flat bar. The "palm" on each spoke was formed by milling down each side. A jig was made for this operation, and another was made for drilling the rivet holes in the correct place in each spoke. The hubs for each wheel were machined from mild steel. The spokes were each bent to shape on a metal jig and made ready for riveting to the rims. Each strake was pressed to its helical shape between two hardwood formers and assembled to the rear wheel rim using four mild steel rivets countersunk on the outside. These were finally filed flush on the outside wheel surface. Different steel jigs were produced for the assembly of the hubs, rims and spokes for the front and rear wheels.

A snappy riveter

The original plans specified mild steel rivets for both wheels, but some initial experimentation indicated that this could be troublesome. I decided to use copper rivets, and to produce a rivet squeezer to carry out the work.

The design for a squeezer included in Mike Wilmot's article on *Pamella II* in AME, July 1991, was used as a basis for a new design to suit the rivets in this traction engine's wheels. This proved to be an excellent way of achieving a very difficult job as easily as possible. With some 172 rivets supporting the wheels, it is unlikely that failure will occur in the softer copper material. The wheels are only out a few thou in concentricity, and they have negligible wobble — a really pleasing result for such a complex fabrication.

Because copper rivets were used, it was unnecessary to heat treat the dies in the rivet squeezing tool.

The fiddly bits

In between all the major machining and fabricating operations, time was spent making some of the smaller fittings and accessories. Many of the smaller items were made very early in the piece as a stimulus to further progress. For example, the whole reversing lever system and dummy Salter safety valves had been completed by the end of 1983. The final drive gear is part of the compensator (differential) housing and this was produced around 1989. Initially, the engine was fully operational without the compensator gears in place. The rear drive was pinned to provide a fixed drive to each wheel, and this certainly made steering more difficult. As I did not have the capacity to cut the compensator bevels, I passed the three pinion and two gear blanks on to Jack Quilter of Model Parts Engineering (*a regular AME advertiser... bmc*) for machining. The three pinion blanks were machined from continuous cast iron bar, and the two bevel gear blanks from grey iron castings. These gears were recently assembled into the compensator housing on the rear axle; now the whole compensator mechanism is fully operational.

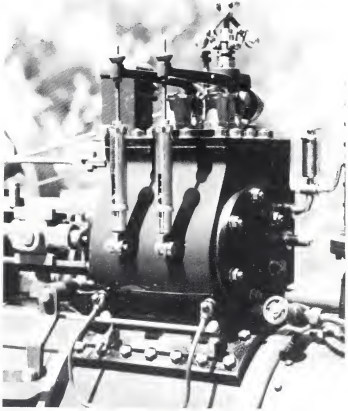
The connecting rod ended up as a fabrication, but a lot of experimentation went into forging a more prototypical one. The major problem faced in the forged work was getting enough heat, and holding the heat while placing the partly forged unit into the dies made to shape the job.

Mounting the cylinder

The boiler has two pads soldered to it: one for the cylinder and the other for the slide bar bracket. To ensure a close fit to the boiler for each of these items, the two pads were machined to the correct radius on the lathe — without turning on the motor! Jigs were made to support each end of the boiler between centres and as the whole unit would not revolve through a full turn, the partial rotation and tool feed were each effected by hand — a time consuming job! Thankfully only a few hundredths of a millimetre had to be removed to achieve a nicely machined surface on each pad.

My method of bolting the cylinder to the boiler, the bolts to be used, and the gasket arrangement for sealing, were issues of great interest to the boiler inspectors who wanted to ensure a safe system. In this respect I acknowledge the advice given by Bob Sanderson from the Hornsby and District Model Engineers Society (HDMES).

To be certain about the strength, specimen bronze bolts were manufactured together with sample "nuts" that represented the copper boiler. These were assembled and tested to "failure" in a tensile testing machine to determine the actual load at failure. The data gained was converted to failure stress and this was compared to the theoretical (calculated) stress under normal operation. A factor of safety was then determined before actual bolts were produced and before the cylinder was bolted down. The gasket at the join was also designed to ensure that, if there was a leak, the lifting load developed on the cylinder would be minimized to prevent any possibility of bolt failure.



Charlie's cylinder with its dummy Salter safety valves, governor, etc.
Photo: Brian Carter

Valve gear

The valves and valve gear were completed somewhere near the end of the production process of the major components. The completion of these allowed the "raw" engine to be displayed at the HDMES birthday weekend in October 1991. Following the display, the engine was stripped down completely to allow fitting of the cladding, and to commence painting.

To feed water to the boiler, the engine has a crankshaft driven reciprocating pump on the near-side, and an injector on the off-side.

The smokebox and perch bracket were painted in heat resistant pot-belly stove enamel. The remainder of the engine parts were undercoated then spray painted in high gloss enamel: the tender, gear guards and boiler cladding in mid-brunswick green, and the wheels, gears and flywheel in vermilion. In accordance with the agricultural nature of this engine I decided not to employ any fancy lining on the wheels or tender. Guards for the drive gears were constructed, with modifications, according to articles written in the June and July 1991 *Model Engineer*.

Final details

After painting, I added pipework, lights, and the brass tender water tank.

The bodies of the driving lights were fabricated from tinplate, brass was used for the turrets and handles. Each body is fitted with a reflector and shaped perspex lens. Although they are not working at present, the lamps are

fitted with a bakelite plate at the base of each body. This disguised plate is designed to be replaced with another bakelite plate fitted with working "peanut" type globes. Suitable wiring will be run to the driving trolley and connect with a battery.

The driver's trolley — a two-wheeled device which has a coal bunker and spare water tank — was constructed and painted to match the engine (vermilion chassis and mid-brunswick green superstructure).

On display at the HDMES birthday weekend in October 1993, *Charlie* took out the society prize for the "Best Model Non-railway Project" for that year.

First run

Trial steaming operations took place at home in December 1993 under the watchful eye of AME editor Brian Carter. This was a very exciting time for all, not the least for the builder! My sons, Peter and Andrew, who had seen this project start in their younger years were there, as was wife Lesley, who had tolerated my ravings and had continued to be a great support. After some minor modifications and adjustments, the fire was lit, and in time pressure began to rise on the gauge. The blower was on, the fan removed: more steam, the regulator open, and *Charlie* was on his way! This was a short run to check if everything was okay, but it was extremely satisfying after so many, many years of hard work!

The steam test

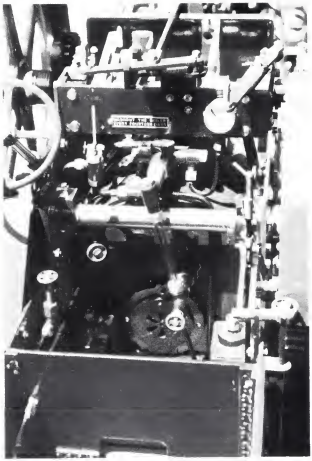
The icing on the cake was the final steam test under the capable supervision of Ross Forsyth, the HDMES boiler inspector, at the 1994 Annual Regatta for the Narrabeen Model Maritime Club. A successful test, the safety valves set, a signed certificate, and the rest of the afternoon was spent steaming among the spectators and members at the Regatta.

Since that time the engine has worked at several HDMES boating regattas at Fagan Park, Galston, where there is a nice flat grassed area. An extensive 170 metre long road locomotive track is currently under construction at the Galston Valley Railway site.

Conclusion

I haven't regretted the decision I made, way back in 1981, to construct a traction engine. I thoroughly enjoyed the experience — despite a few hiccups along the way. The model is performing well and has already provided many hours of pleasure, both for me and those on the side-line. To increase the fun, I have almost completed a larger riding trolley that can take a couple of passengers.

The other part of constructing a model such as this, is the interesting people you meet along the way. There have been many generous offers of assistance when the going got tough. Now, back to those house projects still waiting in the wings... and the Foden wagon!



The footplate.

Photo: Brian Carter

A final view as the author drives ***Charlie*** *off on another great day of live steam.*

Safety...

First, Last, and Always!

Locomotive Fire Prevention Appliances on the Victorian Railways

Doug Baxter looks at spark arresters and other devices

Drawings for publication by Peter Manning

A 4-6-0 Goods locomotive known as S class and numbered 197 to 215 (odd numbers) was built by Phoenix Foundry Company, Ballarat in 1883. Number 197 was later rebuilt and reclassified as W class in 1908 and finally scrapped in 1926. These locomotives were the last to be built with the flared chimney in which a spark arrester was installed.

By 1893 when the first light line engine (an 0-6-0) was built at the Newport Railway Workshops, it was fitted with a single wire grid spark arrester located just above the top row fire tubes which was also the height of the blast pipe nozzle around which fitted the blower. The smokebox door being considerably smaller in diameter than the inside of the smokebox it was necessary to make the grids in two halves with the joint being at the centre line running lengthwise with the boiler. They were attached to the sides of the smokebox to which an obtuse angle had been riveted while ordinary angle iron was studded to the smokebox tube plate. These angle irons were 1½" x 1 ½" x ¼". The grids consisted of ⅝" x ¼" bars machined as in Fig. 1. Originally the bars were cut to length, straightened and clamped together forming sections about 6" (approximately 24 bars) and forwarded to the machine shop for machining the grooves.

Originally No. 6 gauge soft iron wire was used but in later years when this became unavailable mild steel wire was used. Prior to use the coils were placed in the boiler Shop furnace late in the afternoon, heated to a red heat and left overnight to produce an annealed wire. The wire was cut to length and straightened by the wire cutting machine (Machine No. 17 in Boiler Shop Layout Page 46 AME February 1989). Variation in the length of smokeboxes required the wires to also vary in length. The top opening of the slots in the grids were closed over the wire by a cross pein hammer of about 1½ lbs.

By about 1900 it became apparent that one grid was not effective so a second grid was introduced. The grids were about 6" apart and the wires in the top grid ran crosswise across the smokebox while the bottom grid wires ran lengthwise. The use of two grids necessitated the introduction of a spark arrester cone. The cones were made similar to the grids except they were completed on a jig consisting of a machined cast iron cone with slots (usually about eight) machined vertically to take the ribs. The wire was taken directly from the coil and as it was wrapped around each rib it was also closed over. Like the grids, cones varied in diameter and height depending on the type of locomotive.

With the introduction of superheated steam an adjustment to the grids due to the header was necessary. The main problem was the gap between the header and the smokebox which was sealed with plate patches studded to the header.

Wire grid spark arrester were held in place and together at joins by the application of what was known as three hole washers (Fig. 2) and ¼" bolt and a 1" diameter by ⅛" washer at the head of the bolt. The gap in the grids was opened to take the ¼" bolt and the three hole plate washer covered any excess opening. Patches made of ⅛" plate were used to seal the area around main steam pipes and

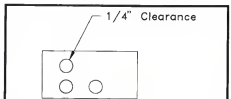


Fig. 2

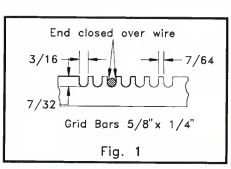


Fig. 1

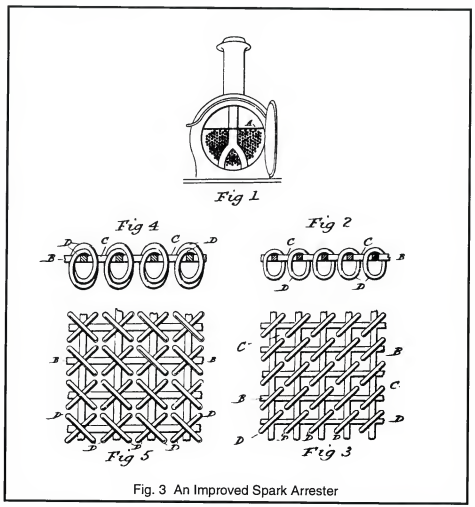


Fig. 3 An Improved Spark Arrester

around the grid and cone joint. The fit between the smokebox door and spark arrester varied, some grids were extended and curved to fit the smokebox door while others had a patch fitted to the contour of the door.

On the 16 June 1893 a Patent Number 10595 was lodged with the Patent Office in Melbourne, Victoria for "An improved spark arrester". Part of the wording of the specifications is "Its construction is simple, comprising a grating (fitted with rings) placed horizontally within the smokebox and fitting closely to the same at all sides, the said grating being affixed just so high that all smoke and cinders from the furnaces enter the smokebox on its under side. This allows a grating of large area to be used, which will not obstruct the draught. This grating does not move when in use but the rings with which it is fitted will move and shake with the motion of the engine, effectually preventing any clogging up of the aperture by smoke and cinders, the later being thrown back in the smokebox where they accumulate." Figure 3 is a copy of the drawing attached to the specifications.

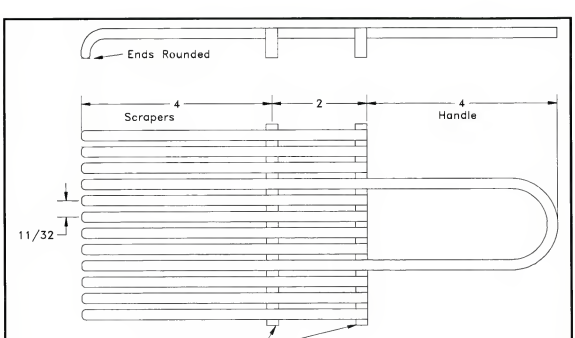


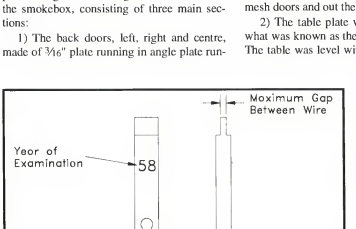
Fig.4 Wire Grid Spark Arrester Cleaner – "Back Scratcher"

This patent was not taken up by the Railways so the wire grid type continued in use until 1934 when Mr E. Brownbill wrote his thesis *Self Cleaning Smokeboxes* for his Master of Mechanical Engineering Degree at the University of Melbourne.

The self cleaning smokebox was a complete change in the design of the interior of the smokebox, consisting of three main sections:

1) The back doors, left, right and centre, made of 3/16" plate running in angle plate runners at top and bottom and sealed to the smokebox side by strips are welded to the smokebox. Cover straps were riveted to the centre door to seal the vertical joins. These cover strips had holes to take the 5/8" studs in the left and right door and when special nuts were applied became a solid unit. These nuts were 1" deep and completely covered the thread of the studs to prevent them from becoming worn away by the abrasive action of the cinders. They were also a larger size than the standard hexagon for 5/8" nuts. The common name in running for the back plates was basher plates since the principle of the self cleaning smokebox was as follows; the cinders travelled down the tubes, hit the basher plates and broke up then dropped down and drawn under the table plate by the draught of the exhaust steam and up through the front mesh doors and out the chimney.

2) The table plate was 3/16" and bolted to what was known as the front and back angles. The table was level with the blast pipe which had now been lowered in the smokebox, and depending on the type of locomotive a grid mesh cage was fitted to adjust any variation in the height of the blast pipe and the table plate.



Fig, 5 Wire Grid Gauge

3) The front doors left, right and centre. Each was constructed of two frames of 1½" by 3/16" mild steel strips between which was riveted the mesh and the outside of the left and right doors were shaped to the contour of the inside of the smokebox. The mesh was 10 gauge wire woven to form squares of 37 to the foot. The side doors were retained in runners fitted in both top and bottom angles while the centre door was attached to hooks on the side doors and retained by ½" keys with a nib. In later years with the introduction of larger locomotives with a powerful blast it was observed that the top area adjacent to the smokebox became worn prior to the remaining areas of the doors and so this area was covered with an additional 1/8" plate. Figure 4 shows a diagrammatic sketch of the self cleaning smokebox.

Attached to the front doors bottom angle were left and right hand deflector plates held in position by a key, wedge and chain. These plates governed the concrete height which was usually 8". For those not familiar with locomotives, the bottom of the smokebox, usually a casting between frames in older engines or the bottom section of a completely round smokebox was filled with concrete (trade name "Nonporite") allowing a gap of about 8" for the cinders etc to fall on before passing under the table plate and finally up the chimney. The height at the tube plate was about 2" below the bottom row of fire tubes.

It was essential to keep the spark arresters grids clean and free from wedged in cinders. The wire grid scraper (Fig. 5) was in the tool box of every engine and from the shape it acquired the name of "Back Scratcher". With the introduction of the self cleaning smokebox a wire brush about 3" wide and 3 foot long with bristles about 2" long for 6" became the standard and was usually carried wedged down between the handrail and the smokebox.

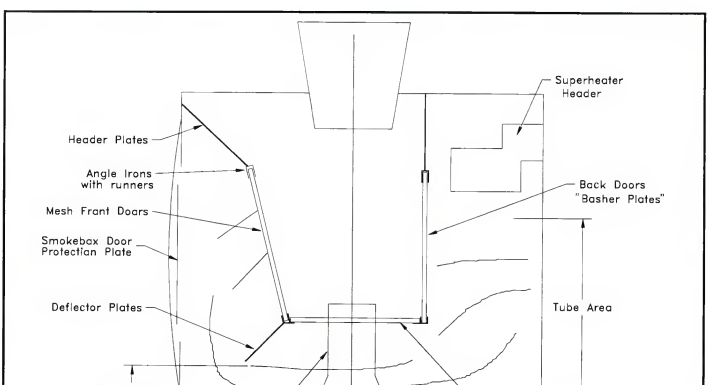


Fig. 7. Self Cleaning Smokebox – showing path of cinders

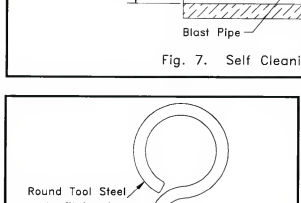


Fig. 6 Mesh Guage

To maintain the effectiveness of spark arresters certain procedures were necessary. When engines left workshops after repairs, all surfaces were to be hard up, that is no gaps but as time progressed in running, the maximum gap was not to exceed ⅛". Special gauges were provided for the wire grids, one end the maximum distance between wires, the other end the minimum diameter of the wire, while in the case of the mesh door a round gauge of the maximum diameter permitted to enter the square holes in the mesh (Figs. 6 and 7). These gauges were sent to the Tool Room at Newport for yearly examination and the year stamped there on.

About the middle of April each year when the weather had broken instructions were issued for the removal of the top grid in the case of the wire grid types and the front doors of the self cleaning types. These were stored in special racks at locomotive depots, being labelled with the engine number and again depending on the season, instructions were issued about late November for their reinstalment in the appropriate locomotive.

Due to costly litigation in the 1960s a supervisory boilermaker was allocated as "Spark Arrester Inspector" during the spark arrester season each year and he arrived unannounced at any locomotive depot and carried out an inspection. During the season it was procedure to examine daily every engine prior to leaving the depot and sign the form stating all fire prevention appliances were in good order.

The ashpan also comes under fire prevention appliances. All sections were fitted up tight prior to leaving the workshops but due to running problems, buckling and burning etc can occur to the plates. As with spark arresters the maximum gap could not exceed ⅛" and should this occur it was necessary to close the gaps or apply patches.

Cleaning Black Steel

by Peter Lukey

To remove mill-scale from black steel and also pickling steel after brazing. Hydrochloric acid (35%) will leave a grey surface on black mild steel quite rapidly, and also remove brazing residue. Unlike sulphuric acid below 20%, it does not dissolve the steel itself. Of course the treated steel needs protecting with oil, etc., afterwards.

Acids are Class 8 Dangerous Goods. So be very careful when handling them. Wear protective clothes and a face shield to protect your eyes. When diluting acids always add the acid to the water *never* the other way around!

Taking Up The Micro Challenge

by Leigh Adams

Photos by Brian Carter

The micro steam car article in *Model Engineer*, 19 May 1995 page 628, caught my eye as a great wet weekend project, with most of the materials coming out of the scrap box. Although the bent wire and sharpened nail construction didn't inspire me, the concept intrigued me. So after some quick sketches and a little bit of lateral thinking I started on my steam powered micro. As each component was cut, filed and machined the project started to grow from what was to be a weekend fiddle to a three weekend major effort.

As with most model projects it takes a little bit longer than first thought, but as each part was completed my enthusiasm grew to see it complete and running. Only simple construction and machining procedures are required but keeping the weight to a bare minimum and selecting the best materials for each part made this an interesting challenge.

Visitors to my workshop soon started asking questions about the little three wheeled vehicle on the shelf and a few cups of coffee were consumed discussing the pro's and con's of the micro.

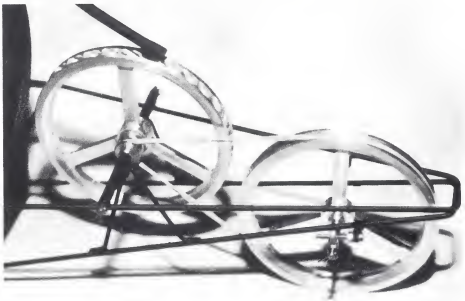
Now complete, its first run was a great success so much so that a mate has been inspired to build one. Why you ask? So we can race 'em of course!

By no means is this a complex locomotive or radio controlled vintage ship but it was a lot of fun without spending a lot of money. As the original article suggested this is a project for the established modeller, and the novice.

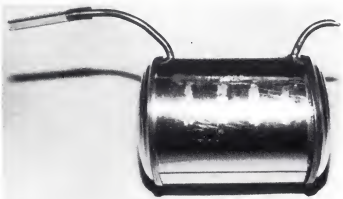
Happy modelling.

The 20ml capacity metho tank fits neatly into a tray beneath the "boiler".

No it doesn't run on batteries, they just give you an idea of the size of this snappy little steam turbine powered car produced from off-cut bits in the junk box and a tomato soup can.



A closer view of the turbine wheel machined with an end mill, the scrap aluminium disk was indexed in a dividing head. The front driving wheel is even fitted with adjustable tracking! The wire frame is soft soldered together utilising a micro-butane torch.



Right: *Following some concern on the safety aspect of the tin can boiler, this can was hydrostatically tested. The ends dished outwards at 344 kPa and the seam on the right burst at 1034 kPa. Given the open nature of the pressure vessel and limited fire, it would be difficult for it to reach bursting pressure in normal conditions.*

Maritime Matters

with Leigh Adams

St. George Birthday

St George Model Boat Club celebrated its 10th birthday with an invitation regatta at their Monterey, NSW, venue. Over 50 model boats and more than 100 visitors turned out for what was to be a spectacular day of good weather and a parade of model boats from around NSW. The St George club had organised a radio compound and canteen, which soon filled the air with an aroma of sausages and fried onions — and they tasted great!

The program for the day was set out on a blackboard with half-hour sessions for scale and power. This worked extremely well and should be adapted by other clubs running inter-club regattas.

Again more new models were on display, showing the ever increasing numbers in our hobby. Power boats turned on the action with a few spectacular flips and some excursions into the reeds on the edge of the pond! One half-cabin cruiser made short work of the lighthouse boat, knocking it base-over-apex and taking a stern first dip in the lake. Both were retrieved in the rescue boat and after some repairs were back on the water in the next session.

The scale runs were a little more sedate but with 20 or so boats on the water at any time, navigation skills were tested with all the traffic. This event was well planed and organised; is was a credit to the club.

NATIONAL REGATTA

Letters of interest are invited from clubs, societies and interested modellers in attending a national model boat regatta in Sydney.

To be run on the Easter weekend 1996.

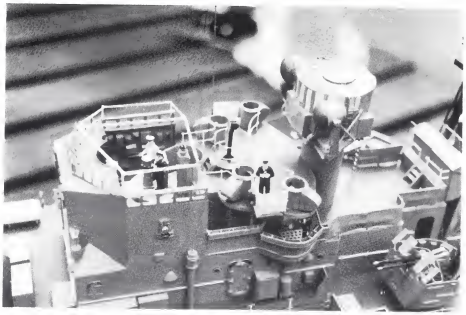
Promoted by the scale radio controlled model boat clubs of NSW. The two day regatta will consist of day and night runs, fun events and trade exhibits.

For further information please write to:

National Regatta
PO Box 1731
DEE WHY, NSW, 2099

Task Force 72

HMAS *Adelaide*, an Adelaide Class guided missile frigate (FFG) of the Royal Australian Navy executed a tight turn to port into the white caps of a heavy sea state six, being whipped up by the cold westerly coming off the mountains. Taking the green seas over her protected forecastle, the modern frigate was followed in line astern by the older ships of the Battle Group, HMAS *Voyager*, the ill-fated Daring Class Destroyer. Following astern of her, the two River Class de-



The bridge structure of Jeoff Eastwood's HMAS ***Voyager****.*

Jeoff Eastwood has just completed this magnificent model of the ill-fated Australian destroyer HMAS ***Voyager****. The model has a GRP hull with cast resin weapons and fittings. The decks and superstructure are constructed with styrene sheet.*

stroyer escorts HMAS *Torrens* and HMAS *Parramatta*, the latter being caught by a large swell, burying the bow back to the twin 4.5 inch gun turret, forward of the bridge. The last ship of the line, F363, a fifty year old veteran of WW2, HMAS *Hawkesbury* — a River Class frigate and considerably smaller than the other units of the Battle Group — begins to broach and starts to fall behind her appointed station. The Commanding Officer, having made his decision, makes a slow turn to port again and forces her way across the angry sea towards the calmer, sheltered inshore water where the rest of the Task Force (TF) were slowly swinging at their moorings, while the Ton Class Minesweeper HMAS *Gull* sweeps the inshore channel for floating mines.

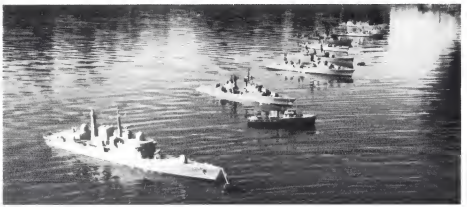
Sounds a bit like a scene from a new Tom Clancy Book? No, this was the scene on Saturday 27 May at Wentworth Falls Lake near Katoomba in the beautiful Blue Mountains just west of Sydney, where the boys of Task Force 72 had a weekend get-together to do what they enjoy most, play with their 1:72 scale, radio control model warships.

TF72 was brought to life by the initial efforts of two men with about forty years' modelling experience between them: Russ French, a serving NCO in the RAN, who has built and repaired countless models of RAN ships for the Navy and Allan Pew, a semi-retired master patternmaker.

Russ and Allan thought of the idea of TF72 while they were working on a display for the Naval Association Vietnam Veterans Reunion held in Coffs Harbour, NSW in October last year. Their idea is not to form a formal club, as most of them already belong to at least one scale model boat club, and they didn't want to cause any friction with the clubs or start pilfering members from other clubs. The basic concept was to form a register and mailing list of people all over the Australia and New Zealand who have 1:72 scale model warships, both radio control and static. People on the list will have access to information to enable them to contact others, who may be building similar models, for the exchange of ideas and problem solving. At times people will get together to sail their models and try to perfect mass manoeuvres and battle situations. They would eventually like to see 1:72 as the predominant scale for warship models in this country. This seems to be the way things are going, as they have close to 100 models on their register so far!

Most of the members, who are building new models opt for a one-piece fibreglass moulded hull, with decks, deck houses, superstructures and masts scratch built of styrene. Weapons and fittings are cast in polyester resin. Most models are powered by 6 or 12 volt electric motors with full electronic speed controllers including inbuilt reverse. Weapons and radars can rotate. Sound effect systems produce sirens, alarms and ordinance effects. And there is a vast range of helicopter kits available to suit the wide range of ship types.

Spencer Day's KM ***Bismark*** *and Allan Pew's HMS* ***Hood*** *— both around 4m long.*



A realistic scene on Wentworth Falls Lake. The lower left ship is Allan Pew's Type 42 destroyer HMS ***York****. This model has a GRP hull with cast resin weapons and fittings. The radar domes are vacuum formed styrene. An interesting feature of this model will be the sound effects.*

The variety of models involved goes from the small Matchbox Flower Class corvettes up to the four metre long battlewagons *Bismark* and *Hood*. A couple of Australian aircraft carriers are also under construction. Imagine a flight deck covered with Gannets, Skyhawks, Grumman Trackers and Sea King helicopters! An auxiliary tanker is being built in Mooloolaba, Qld and a liberty ship hull has just been produced by APS Models, which could end up covered with Sherman tanks and Liberator Bombers over her decks. A Russian Typhoon Class submarine kit is also in the pre-production stages. This monster of the deep is over two metres long with a beam of 320 millimetres. After all there has to be at least one "baddie" for the Task Force to dump on!

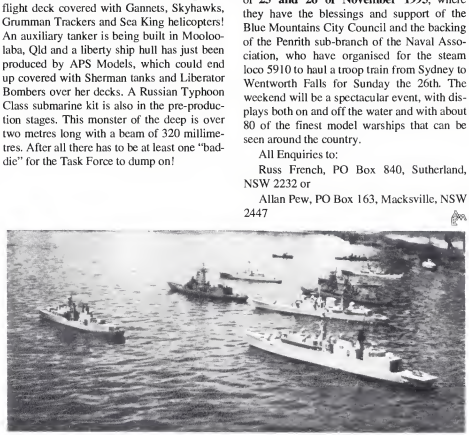
1:72 scale model warship regatta

Task Force 72 will hold its first "big" regatta at Wentworth Falls Lake on the weekend of **25 and 26 of November 1995**, where they have the blessings and support of the Blue Mountains City Council and the backing of the Penrith sub-branch of the Naval Association, who have organised for the steam loco 5910 to haul a troop train from Sydney to Wentworth Falls for Sunday the 26th. The weekend will be a spectacular event, with displays both on and off the water and with about 80 of the finest model warships that can be seen around the country.

All Enquiries to:

Russ French, PO Box 840, Sutherland, NSW 2232 or

Allan Pew, PO Box 163, Macksville, NSW 2447



Again on Wentworth Falls Lake, Right foreground is David Rowland's HMS ***Cumberland****, Batch 3 type 22 frigate. To the left is Allan Pew's HMAS* ***Vampire****.*

Club Roundup

Narara NSW

The Central Coast Steam, Model Co-op Ltd, operators of the Gosford Miniature Railway, has a new president and secretary, husband and wife Graham and Edith Bearman. At the society's AGM on September 28, Tom Winterbourn stood down as president after three years in office, while foundation member, boiler inspector and club stalwart Lindsay Brack did not seek re-election as secretary after eight years in office. Tom Winterbourn was elected Vice- President, Mick Farrell re-elected Treasurer and Bruce Langton members' representative on the board. The AGM, held in the club carriage at the track, was attended by almost 40 members.

The club, meanwhile, continues to make progress on its clubhouse project, having temporarily moved the carriage and completed earthworks for its new site. At the time of writing, the retaining wall for the new carriage site was almost complete. After rail has been laid on a new concrete pad, the carriage will be re-positioned, allowing earthworks for the new clubhouse to be carried out. Gosford City Council earlier this year approved both development and building applications and, more recently, approved engineering drawings. Because of the flood-prone nature of the land, the floor of the building will be at least two metres above ground level, or above the highest known floor level. The building includes a toilet block, food-preparation area with servery, two storerooms, meeting hall and an extensive balcony overlooking the track. The lockable ground level area will be used for the storage of carriages, tractor, mowers and other equipment.

In its development application, the club applied for and was granted lease of an additional six acres of land on the city side of the swamp for track expansion. A trestled track is being constructed through the swamp, with a bridge over the water course at the city end. Over two-thirds of the concrete pads for the trestles have been laid and about 20 trestles are in position. When the proposed trackwork has been completed, the society maintains it will have one of the most interesting tracks in the state.

All club correspondence should be addressed to the secretary, PO Box 692, Gosford 2250. President Graham Bearman and secretary Edith Bearman can be contacted on (043) 882416 and vice-president/publicity officer Tom Winterbourn on (043) 254838.

The Central Coast Steam, Model Co-op Ltd.

Location: Lot 10 Showgrounds Rd. Narara

Public running day: 1st Saturday of each month

Thames NZ

The Thames Small Gauge Railway Society Inc has since it's establishment in 1993 financed and established a 137 metre temporary 5" and 7¼" track on the Thames Foreshore, and given public running on most Sunday afternoons. This has received good public support and most of the public indicate it as being a great local asset.

We have proceeded with plans and procurement of materials for the laying of the permanent track along the foreshore to Victoria Park.

The Society is now working in raising funds and materials for the permanent track. This is mainly done by raffles, train rides, membership fees badge and shirt sales and donations. We have received monetary donations from Trust Bank Waikato in the past two years. A couple of business houses have given smaller monetary donations and donations of raffle goods.

The funds so far accumulated have enabled us to recently purchase with the help of Toyota NZ seven tonnes of steel for rails. A car hoist was purchased from Hawera for the turntable at a cost of removal and transport. This material is fully paid for. Privately owned locomotives and running gear is presently used but in due course society rolling stock will be purchased.

With resource consent now granted work will proceed this summer with earthworks to extend the track along the fore shore. Plans are underway for the heritage style station of the late 1800 design.

New track is being fabricated in three metre lengths of which 200 will be required. The curves will be fabricated on site.

Recently the information center day 48 people from various information centres visited the track and were most impressed with the prospects of the permanent track. Seven play centres visited the track prior to last Christmas and enjoyed the facilities.

The club members have amongst them five steam locos and five electric locos with several new ones under construction.

The society membership exceeds 40 and visitors are welcome to visit. Contact can be made with the president Stephen G. James on Ph (07) 868 6678

Thames Small Gauge Railway Society Inc.

Location: Brown Street, Thames, NZ

Public running day: Every Sunday 1pm - 4pm

Castledare WA

Bidirectional staff running was attempted on the Club members run day of 23 July 1995. The running covered all the railway being broken up into five staff sections and one dual track section. All ran smoothly with over thirty members attending during the day and nine locomotives participating in the run. It was a busy day but one thoroughly enjoyed by all with the request by most to do it again as soon as possible and even try it on a public run day!!

Rumours abound that the railway will be closed due to redevelopment of church land above where the railway exists largely on river reserve. This is far from the truth as all the heads of relevant government bodies who will take control of the land the railway is on are adamant the railway is to stay! The only concession may be the possible need to relocate public car parking to one of the inside loops of the railway circuit.

Castledare Miniature Railways

Location: 100 Fern Rd, Wilson, WA

Public running day: 1st Sunday of each month.

Bankstown NSW

Please note that the club has a new mailing address: PO Box 24, North Revesby, NSW 2212.

Following this years AGM the society has a change of management.

President: John Clark.

Coming Events

4, 5 November
Invitation run - Wagga Wagga
Info contact: David Font, PO Box 119, Mt. Austin, NSW, 2650. (069) 21 4762

19 November
Gisborne Steam Park Tractor Pull
Gisborne District Steam and Engine Society. Gisborne Steam Park, Webb Cres. New Gisborne (Melways 197 F4). Contact: Arthur Boyd (054) 28 9202 for further information.

26 to 31 December
Manukau Summer Holiday Meet
Manukau Live Steamers Inc. Mangere Centre Park. Robertson Rd. Mangere, Auckland NZ.

5 to 10 January 1996
Steam Expo 96 - New Zealand
Otago Model Engineering Society. Contact the Convener, PO Box 2163 Dunedin 9030 New Zealand.

24, 25 February 1996
Lake Macquarie Birthday Run
All model engineers are invited to the 4th Annual Birthday Run of the Lake Macquarie Live Steam Locomotive Society. Off Velinda St. Edgeworth, NSW.

Secretary: John Connor.
Treasurer: Alan Taylor.
Bankstown Live Steam Locomotive Society
Location: Ruse Park, Hoskins Ave. Bankstown.
Public running day: 2nd Saturday of each month.

Wollongong NSW

At the July AGM the following members were elected to office.
President: Ross Edmondson.
Secretary: Warwick Aston.
Treasurer: Ivo Bunker.
Illawarra Live Steamers Co-op Ltd.
Location: Virginia St. North Wollongong
Public running day: 4th Sunday of each month.

West Ryde NSW

The new pedestrian footbridge in the centre of the grounds is now complete. The fabricated, galvanised structure is a credit to the team that worked on the project. The new flag pole is in place and really sets off the railway atmosphere on running days. As with all railways, large and small, there is continual track maintenance and upgrading. New sections of track have been fabricated to replace some of the original trackwork. New, and standardised features have been incorporated in the new track. Following the AGM, Warwick Allison in now the club president.
Sydney Live Steam Locomotive Society
Location: Anthony Rd, West Ryde
Public running day: 3rd Saturday of each month.

Galston NSW

There is always something happening with the Hornsby and District Model Engineers — the problem is what to leave out! The annual steam fest has just past and, as usual, was a most enjoyable event for all those who attended over one or all three days. The Mayor of Hornsby, Stephen Pringle, officially opened the new 170m long meandering traction engine track. Mike New and John Gibson ran their traction engines around the track for most of the day. Another special feature of the weekend was the restored operation of the club's 12 inches-to-the-foot scale 20hp Ronaldson and Tippet engine in its new engine house. Garth Cantrill devoted all of his annual leave plus many hours over weekends to the project. The engine runs extremely well and is characterised by the hit-and-miss action of the governor and firing mechanism. Hopefully we can twist Garth's arm enough to tell us about the engine in more detail. The weekend also includes a display of members' work. This year the HDMES prize for the best non-railway model went to Vernon Brown for a very well made Quorn tool and cutter grinder. The marine contingent was well represented with a large static display of boats covering; sail, steam and internal combustion powered propulsion. Other regular displays include the stationary engines, old and less old workshop tools and a fascinating display of horse-drawn vehicles.
Hornsby and District Model Engineers Co-op Society Ltd.
Location: 29 Mid Dural Rd. Galston.
Public running day: 2nd Sunday of each month.

Mangere (Auckland) NZ

The Queens Birthday weekend run was very successful, despite some annoying weather conditions. This year the visitor count was down with some of the regulars away on a trip to the IBLS meet in the USA. *Phantoms* were in abundance with Dave Giles' *Phantom* and Ian Welch's *Hiawatha* being on loan to club members. Steve James and Bob Sharman from the Thames club also brought their *Phantoms* along. The "Bits and Pieces" night showed a lot of talent and new projects within the club [I am curious how the double Fairley will be fired, perhaps one of the boilers is a dummy?.. ed].
Manukau Live Steamers Inc.
Location: Mangere Centre Park, Robertson Rd. Mangere.
Public running day: Every Sunday.

Los Angeles USA

The 1995 International meet of the International Brotherhood of Live Steamers was held at the grounds of the Los Angeles Live Steamers. It was no doubt the biggest and most successful international meet held so far. there were four pre-meet visits and eight post-meet visits of clubs north and south of the LALS track.

The meet was attended by 3000 delegates who came from about 25 US states international visitors came from Britain, Canada, Germany, Japan, New Zealand and South Africa [It seems Australia was not represented... ed]. The Steam, electric and diesel locomotives present were supplemented by John Darby's Calliope which serenaded many people with steam powered music. Also present was a steam plant with can crusher, steam whistles, stationary engines, a button stamping machine, a steam shovel and a gauge 1 track. Many vendors offered a wide range of goods from badges to complete locomotives. The two US model publications, *Modeltec* and *Live Steam* also had display stands.

Lindsay McDonnell, the President of the British Columbia Society of Model Engineers, of Burnaby (near Vancouver) Canada, was also present. The British Columbia Society is hosting the year 2000 international IBLS meet. It will be the first time the international meet is hosted outside of the US. The British Columbia Society intends to install a 5" gauge track and possibly modify the 7½" gauge points to allow 7¼" gauge locomotives to pass through. This will allow a truly international flavour by enabling locomotives from many parts of the world to participate.

With regard to the Los Angeles meet, it was gratifying to note that Doc Art Reiter said, that after 32 years in the hobby, he had never seen such co-operation among clubs in arranging pre- and post-meet visits.

Ken J. Barnes, IBLS Secretary, Southern Africa.

If you wish to participate in the year 2000 IBLS meet, contact:
Barry Glover (042) 84 0294, IBLS Secretary for Eastern Australia.

Bloemfontein South Africa

The 15th South African National Live Steam Meet ,17 to 29 April 1995, was hosted by the Bloemfontein Society of Model Engineers. It proved to be the largest ever gathering of miniature SAR locomotives, totalling 17. There were 94 visitors and 52 from the host club who brought a collection of 58 locomotives ranging from a *Rob Roy* to a 1:8 scale SAR Class 23. There were eight *Simplex* locos and five *Sweetpeas* in various forms. Both tracks were kept busy for the five days, at one time there were 22 trains operating together! The public invaded the grounds and around 3000 passengers were carried, at one time the queue was so long that they were holding all the available tickets! TV coverage was good which resulted in quite a bit of publicity for the hobby. It was a very successful meet, held in a most congenial atmosphere and greatly enjoyed by all.

Ken J. Barnes, IBLS Secretary, Southern Africa.

Fairfield NSW

Western Districts Live Steamers
Location: Fairfield showgrounds, Smithfield Rd. Fairfield West.
Public running day: Every Saturday.

Morhpett Vale SA

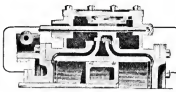
Morphett Vale Railway Inc.
Location: Wilfred Taylor Reserve, Wheatsheaf Rd, Morphett Vale.
Public running day: 2nd & 4th Sundays of each month.

Club Roundup contributions

AME is pleased to receive club newsletters for consideration in this section. Newsletters are often a good source of articles, which we appreciate all the more, but most of all they help us keep in touch.

It is often difficult to decide what to publish and what to leave out. and the task of selecting material for a wider audience takes a lot of time. Also, there is always the risk that AME will publish something that the club considers sensitive. Please help by sending a "press release" page with your newsletter, or highlight the items you think we could use. We'll give first preference to clubs that help us out this way.

bmc

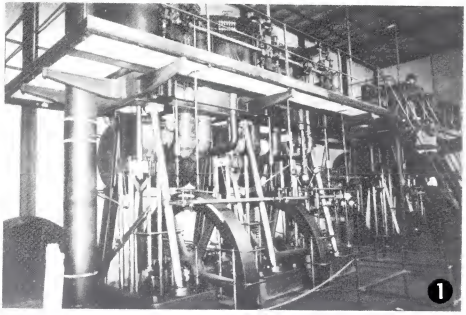


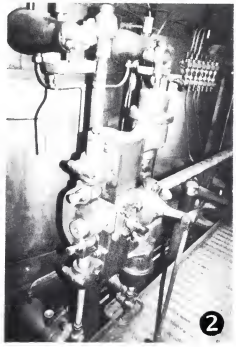
Steam Chest

with Dave Harper

Hi there steam fans! Welcome to another helping of steamobilia [well, that one blew my spelling checker!... bmc]. More good stuff has come in from reader Ted Whitehead. Ted recently discovered a magnificent pair of triple expansion pumping engines way out in the bush near Broken Hill.

Known as the Umberumberka engines, after the creek and reservoir they are built on, the name apparently is an Aboriginal word meaning *native rat hole*.



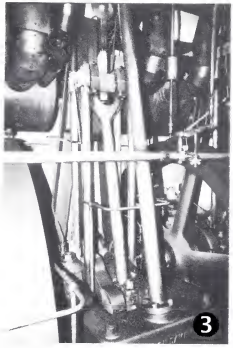


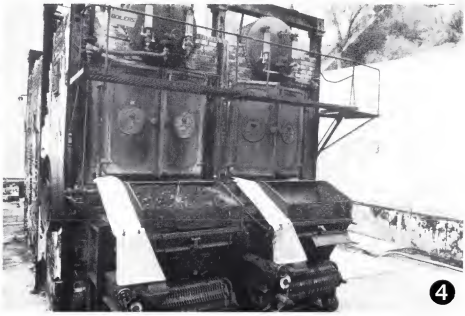
Although Ted thought they would be well known, nobody that I have mentioned them to so far has heard of them, so apparently they're not well known at all!

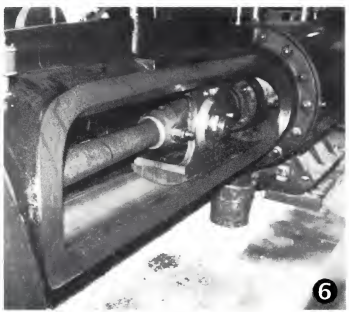
The engines were installed in the 1920s to pump water from the Umberumberka reservoir to Broken Hill. They were replaced by a group of *Enterprise* diesels in 1960. Although tenders were called for the removal of the engines, their location is so remote that no-one was bothered to tender. So, they sit there to this day, in immaculate condition, thanks to the very dry conditions, a forgotten monument to our steam heritage.

Ted has dug up a remarkable amount of information on the engines, and is still communicating with the Broken Hill Water Board, the current owners, for more.

The engines were built by Hathorn-Davey of Leeds, England. They have cylinders of 16", 28" and 48" bores by 36" stroke — and most unusually for vertical engines of this type, they have Corliss valve gear. I believe Hathorn-Davey specialized in this arrangement. They were rated at 300hp each at 32-38 rpm and 175psi steam pressure. There were three pumps to each engine, driven by four vertical rods from each crosshead. Bore was







12.5", stroke 36" and pumping capacity 96000 gallons per hour.

Steam was supplied from what Ted describes as a standard twin horizontal drum water tube boiler by Babcock and Willcox with chain grate hopper coal feed.

The boiler and coal staithes are still intact but open to the elements. The original engine/boiler shed was demolished, but a new shed was built around the engines when it became clear they weren't about to be moved!

Ted also supplied me with some excellent photos, some of which are reproduced here: photo 1 is a general view showing the size of the engines. Photo 2 is a close-up of the valve gear on one cylinder, quite different to the wrist plate motion usually associated with Corliss valve gear.

Photo 3 clearly shows the four rods connecting a crosshead with the pumps down below. This arrangement takes the power direct from the piston rod and leaves the crankshaft and flywheels unloaded, acting more for guidance and smoothing than power transmission.

Photo 4 shows the boiler complete with chain grates and hoppers. It's altogether an amazing remnant — a pity its remote location would make any attempt to properly preserve or operate the engines impracticalble.

If anyone has any further information on these or similar engines, I'd be very pleased to hear from them — and so would Ted Whitehead, I'm sure! If some drawings could be found they would make a marvellous and different modelling project!

Trunk crosshead guides

Digging through my photos for this series, I came across a little engine (photo 5) that seems to represent a link between the original flat bar guides and the bored-out trunk type.

This simple little winch is apparently an ash hoist, used to remove ash from the boiler room of a ship. It consists of two cylinders with valve gear between them, and a winch drum mounted directly on the crankshaft.

As I hope can be seen in the photo, the crosshead guides are cast integral with the frame, and although flat on the outside they have been machined to a circular section.

Compare this with photos 6 and 7, which are of my favourite engine, the 1926 Stewart mill engine at the Qld Steam & Vintage Machinery Society's Boiler House Museum at Petrie, Qld.

I spend most weekends admiring this lovely old engine and watching visitors becoming hypnotised as the huge crosshead moves slowly back and forth in almost complete silence.

The engine has a 24" bore and 48" stroke, and the crosshead bore must be around 12". I know the 15ft flywheel weighs about 9 tons, but no-one can tell me the weight of the reciprocating parts... pretty heavy, anyway!

This crosshead is the classic trunk style, machined from one big casting that is cut away at the sides for access and lightness. The working surface is bored circular and the crosshead slippers scraped to match.

This type of crosshead is common on all sorts of engines — stationary, portable and traction — so it was obviously a very successful and economical solution to the problem of guiding the piston-rod and absorbing the side thrust of the con-rod.

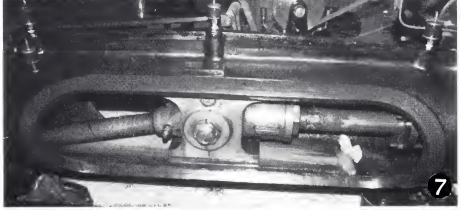
An odd precursor of this idea was popular in the 1870s when the trunk engine was introduced for marine use.

This type of engine effectively wrapped the piston around the crosshead and trunk and the whole assembly reciprocated through huge steam glands at each end of the cylinder. The idea was to reduce the width of the engine as at that time the engines were laid flat on their sides driving the screw shaft in the early steam warships. The Admiralty had decreed that all the machinery was to be below the waterline to protect it from shellfire!

I've recently come across reference to trunk engines in a book entitled *Marine Engineering* by N. P. Burgh, published in 1872! This book, kindly lent to me by Trevor Bentley of Woodford, will be reviewed in a Bookchat sometime soon. At the moment I'm still trying to make sense of some of the descriptive text. This book wasn't written for the uninitiated!

Anyway, that seems to be more than enough steamchat for this time.

Happy steaming!



Maryborough Odyssey

A Steam Chest Special

by Dave Harper

The idea of going up to Maryborough, about 250km north of Brisbane, had been germinating for some time. I'd heard of Peter Olds' steam-powered factory, then I found out that the Maryborough Sugar Mill still had a reciprocating steam crushing engine.

The final clincher was when Neil Mackenzie told me that the Model Engineering and Live Steam Association of Maryborough (MELSA) were to have a QR loco day at the end of July. This set me to work, firstly to arrange with she-who-must-be-obeyed to go away by myself for a few days, then travel and accommodation bookings.

The first hurdle negotiated, I decided this was a good time to try QR's new electric inter-city train, the *Spirit of Capricorn,* which runs daily between Brisbane and Rockhampton. Picking it up at Caboolture, $60 return seemed a good deal. Accommodation was found at a good motel halfway between Peter Olds' factory and MELSA's track in Queen's Park.

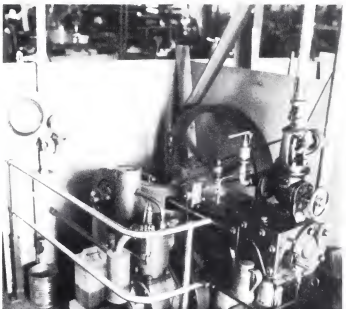
I arranged to go up on the Wednesday train as Peter Olds steams his factory on Thursdays to tie in with the heritage markets held in Maryborough. That gave me Friday to see the sugar mill and the weekend to meet the guys from MELSA, returning home on the Monday train.

On the way

The train trip up was most enjoyable. The aircraft-type seats, only three abreast on our narrow guage, the aircraft-type trolley refreshment service and the smooth running were very impressive.

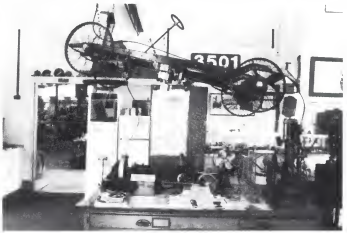
Early Thursday I was outside the Olds works with its display window full of the many and varied products of this 1918-established firm.

To the left of the main shopfront is the Olds Engine House containing a display of William Olds' models — William was Peter's father and founder of the firm — plus many samples of jobs and products of the firm.



This compact Tangye engine is a Soho model, 5" bore x 6" stroke, built in 1912 and used in a sawmill at Miriam Vale, Qld until 1970.

The window display is unusual, featuring a 1906 Clayton & Shuttleworth portable engine and several small cannon made here.



The frame of a model steam car built by William Olds in the 1920s based on an Essex tourer, but powered by a flat-four steam engine.

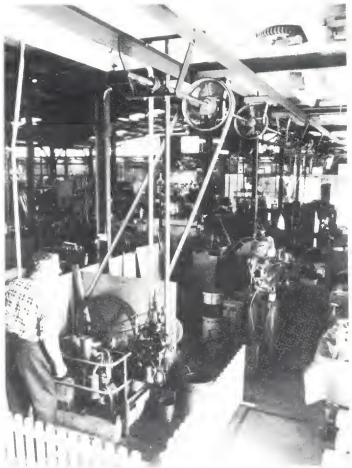
Peter met me and took me straight out the back to meet Bob Lisle, his old friend and model engineer who helps by looking after the boiler and steam engine on running days. Back in the museum room, there are a multitude of models, patterns and machines on display, all labelled — enough for several hours' browsing.

The frame of a model steam car built by William Olds in the 1920s hangs from the ceiling; it is based on an Essex tourer, but powered by a flat-four steam engine. There are photos of Peter driving it when he was but a toddler! On the table is a model winding engine built in about 1906 by father William at age 16. With it he won a bronze medal at the local show and scored an apprenticeship at Walker's — Maryborough's best known engineering works, and still going strong today!

At the other end of the room is a 5" guage model of *Mary-Ann*, the first steam engine built in Queensland, by Walker's, naturally. This was in the 1870s, and the loco was used by timber workers, not only to haul wagons, but to winch timber out of the forest and then drive the saw to cut it! They cut their own rails from timber too!

Currently, Maryborough City Council is discussing the building of a full-sized replica of *Mary-Ann* to run on the branch line through the city as a tourist attraction. You can guess who the main builder will be!

By this time the boiler was up to pressure and the Tangye engine was ready to go. It is a Soho model, 5" bore x 6" stroke, built in 1912



The layshaft overhead drives various workshop machines. The machines are driven by an electric motor when not steam-powered as they are used in the everyday work of the factory.

and used in a sawmill at Miriam Vale, Qld until 1970. It still runs like a sewing machine too! The layshaft overhead drives a lathe and a grinder among other things. It is driven by an electric motor when not steam-powered, as the machines are used in the everyday work of the factory.

By lunchtime I had seen all around the place and enjoyed a pie heated up next to the boiler, and coffee produced by Peter's version of the Windermere kettle — a steam pipe from the boiler. Peter decided he'd contact the Sugar Mill and see about taking me over there.

Trouble at'mill!

After several attempts, we were told "there's trouble at'mill lad, and t'engineers are busy." "What the hell!" says Peter, "we'll go down there anyway". Leaving me outside, Peter wandered into the mill and

A general view of the mill engine that drives the crushing rolls.

tracked down the engineers. He was told, in effect, "come in, take your pictures, keep out of our way, and clear off!" Given their circumstances at the time, this was understandable.

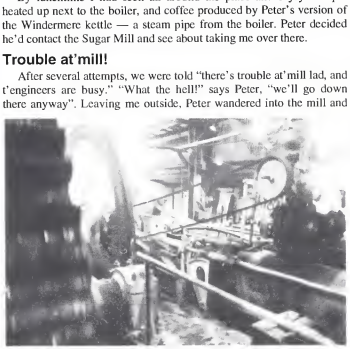
My first impression of the mill was of a huge tin shed filled to the roof with machinery all going full-bore and creating a mind-numbing racket! Briefly: the sugar cane is dumped from trucks down a chute where it goes through a shredder, then three stages of crushing to extract all the juice. The remaining fibres, known as bagasse, are fed into the boilers as fuel. It is this availability of free fuel that makes the use of steam viable in these mills. Steam is used in the processing of the sugar, frequently after already going through the engines and/or turbines and exhausting at about 30psi. Very economical folks these!

The c1900 Walker-built engine drives the first-stage crushing rolls. In the photos, note the flat bar crosshead guides and the huge counter-weight for the valve linkage.

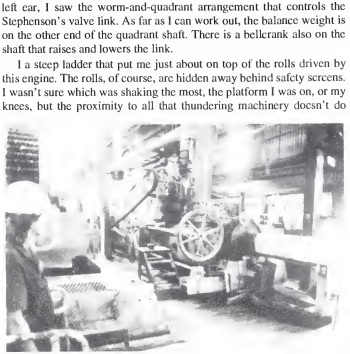
Moving on around the engine is the big valve wheel, the governor and the piston tail-rod running on a slipper guide, a very old design feature. It is under the curved-top safety cover. Also shown in the photo below is the young lad asked to keep an eye on us! Communication was difficult — shouting at three inches range — so we didn't talk much.

Moving further round, with a huge greasy gearwheel skimming my left ear, I saw the worm-and-quadrant arrangement that controls the Stephenson's valve link. As far as I can work out, the balance weight is on the other end of the quadrant shaft. There is a bellcrank also on the shaft that raises and lowers the link.

I a steep ladder that put me just about on top of the rolls driven by this engine. The rolls, of course, are hidden away behind safety screens. I wasn't sure which was shaking the most, the platform I was on, or my knees, but the proximity to all that thundering machinery doesn't do



The lower centre area of the photo shows the worm-and-quadrant arrangement that controls the Stephenson's valve link.



The big valve wheel, the governor and the piston tail-rod running on a slipper guide, a very old design feature.

much for one's peace of mind! I shot off two or three pictures quick-smart and scrambled down again. Luckily, they all came out remarkably well, and show the two stage reduction gearing from the engine to the crushing rolls. The total reduction seems to be about 10 : 1, so taking the engine revs/min at about 60, the rolls do about 6 revs/min. On the way out I compared a stack of spare rolls with Peter and friend 'Mac' (both about 1.7m tall) to give an idea of their size: the rolls are about 1m diameter by about 3m long!.

Turbines are gradually replacing the old reciprocating engines in the mills. Seeing the small size of them, including the reduction gearbox, and the relative simplicity of the exterior, it's easy to see why they are preferred!

I have often wondered why it's been so hard to obtain photos of sugar mill engines for our display at Petrie. Now I know why! I was using 1600ASA film and was still down to 1/30sec at f2 for most of the shots. At least the slow shutter speed gives a great impression of motion.

Once out of the mill, and having let my brain and my knees recover from their ordeals, Peter took me back into Maryborough where I smartly found a nice quiet coffee shop!

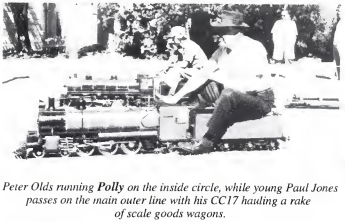
Trains at Queen's Park

On Saturday I wandered along to Queen's Park and introduced myself to the MELSA members of Maryborough. They were having a quiet club social day, and a very pleasant day it was too.

Sunday was the QR day, and the QR locos rolled in from far and wide. Father and son team David and Paul Jones travelled all the way from the Gold Coast; Em and Dale Dietman from Ipswich; Ray Schilling from Nanango; Neil Maekenzie and Jason Christopher from Brisbane. Plus of course the local MELSA lads. Once things got up and running, there was such a queue of people waiting for rides that there wasn't time to have a static photo shoot. It was a case of grabbing shots as and when the opportunities arose. The very bright winter sun limits the angle of shots available too.

The QR locos

A very famous loco, *Polly*, built in 1933 by William Olds, she is a B18¼ is built to the usual ⅛th scale at 5" guage. It was used at numerous local shows, earning its keep hauling passengers around a 20.4m diameter portable track. In 1934 William Olds sold the whole outfit to some local showmen and built another loco. The second one, a



Peter Olds running ***Polly*** *on the inside circle, while young Paul Jones passes on the main outer line with his CC17 hauling a rake of scale goods wagons.*

Ray Schillings' A10 class, resplendent in its blue livery.

Dave Dietman, son of Em, had a good day with his green A12, still waiting for the headlight!

BB18¼, known as *Sally*, wasn't completed until 1945, when she too was sold.

Many years later, Peter Olds managed to get them both back to Maryborough and fully overhauled them. *Sally* now belongs to Brian Fogarty, but lives in the Olds' museum. Peter showed me an old photo of him driving *Polly* in 1934 at age 4! He still drives her pretty well!

The CC17 is a loco that never was, the first one being scrapped before completion in the 1960s when diesels took over. The drawings survived, however, and this model is the result.

Jason Christopher drove an A12 with a good load of passengers while Neil Thompson tried out his brand new (Honda petrol-powered) diesel-hydraulic shunter

Power to spare! Paul Jones and Bruce Hielscher spent a lot of time double-heading a rake of goods wagons around, generating considerable interest from the general public. It's great to see young lads following on in the hobby. They are our future!

Finally, on the way home on the Monday I couldn't pass No 299, Walkers No 1 loco for QR, now preserved at Maryborough railway station, neither could I resist a shot of the crosshead!

I'd like to thank Peter Olds, Bob Lisle, Bob Kimber and all the other nice people I met in Maryborough for making my stay so pleasant. I hope if you haven't been to Maryborough yet, you'll soon get to see its many attractions!

The CC17 comes around again with Paul Jones having a great time.

Ray Jorgensen lets his D13½ do all the work.

Miniature Railway Signalling

by Warwick Allison

Photographs by the Author unless otherwise noted

Increasingly, miniature railways are installing signalling systems, varying from the simple to the elaborate. However, it is rare for the fundamental principles of signalling to be fully understood. And systems that may work fine on a model railway may not be particularly suitable for a passenger carrying miniature railway.

An analysis of full-size systems can provide the philosophy to be followed on a miniature railway much better that merely copying model railways, or reinventing the wheel yourself. While there may be many ways to achieve the same result, probably the most consistent and successful is to emulate full-size practice. This article will detail these principles.

Why signal?

It is important to have a reason for signalling. While railways may not look complete without signals, it is also not right for them to be mere decoration. Nothing looks worse than trains rampantly ignoring signals because they have no real function and the signaller has become bored with operating them. Unless there is a real need, it is better not to have them.

Once track layouts become sizable with considerable traffic, it is worthwhile to bring point operation back to a central location. This minimizes the number of people required to run the railway and consolidates the traffic control with one person. This is a safety and operating bonus: as where technology is introduced, it becomes relatively easy to interlock the various points and signals.

Principles of signalling

With remote operated points, signals become a necessity: first to convey information to the driver as to the route that is set and the possible state of the track ahead, and second to prevent conflicting movements.

It is not acceptable for the points to be operated by one person and the signals by another: the two must be interlocked. While this provides a high degree of safety, a much more important reason is that it provides integrity to the system, without which the drivers would quickly lose confidence. If this occurs, then the system is useless. So what are the requirements?

Henry Spencer has the turnout indication into the platform road on the left. These signals follow NSW single light practice.

Double 30Ts and a friendly wave from Maurie Haynes as he leads Neil Sorrensen with a full load.

The driver's point of view is the most important here — to interpret the indications and drive the train accordingly. Putting ourselves in the driver's seat we would want the following from the system:

- clear and consistent indications,
- signals that only cleared up in front (that is, no signals suddenly going to red in front of the driver),
- reliability, and
- an assurance of a safe system.

The signaller would have a different viewpoint, namely:

- simple operation,
- indications that the functions are operating correctly,
- reliability,
- tracklocking to avoid points being operated under a train, and

- control over the train running to ensure trains are advanced only when it is safe.

Overall, the most important thing in a signalling system to achieve the above features is consistency throughout. Let's take each of the components in turn as we build up the system.

Signals and indications

Before you start, decide on the signal indications to be given. It is logical here to follow full-size practice. Some systems may require two heads (that is, to give a double light indication) and obviously that substantially increases the work required to manufacture the signals. Pay special attention to the indications to be given for turnouts, or shunting moves.

It is sensible to consider if the prototype indications could be simplified without losing the meaning. A good example is the marker light provided in NSW single light signals for locating the signal if the main lamp has burnt out. Obviously any misfortune that may be encountered from this problem would be negligible compared to full-size and as it is a "second level" of safety, there would not really be any need to include it in a miniature system unless you wanted to be absolutely prototypical. Also, speed signalling systems such as used in the USA and Victoria are difficult to apply in miniature. The multiplicity of indications that these systems can supply, and the lack of a specific route indication, makes them less attractive for our purposes. The general need for drivers to be shown the route they are to take is more important on a miniature railway than a speed indication that is route-independent. A satisfactory solution would be to restrict the medium or low-speed indications to turnout routes only. If drivers have to look at the points to understand where they are going, then the signal indication system has failed!

Don't mix indications from different systems, as this is confusing, and remember visiting drivers should not need more than a few laps to become familiar with the system. Make sure the signals look right and are properly dressed by having bases, number plates, hoods, etc. Proportions are important and nothing stands out more than a signal with an oversize post, or undersized hood. Shunting signals should be visibly different.

Sun is a major problem with colour light signals. With a decent lamp (18 watt), and a hood, problems can be minimized — except perhaps west facing signals in the late afternoon.

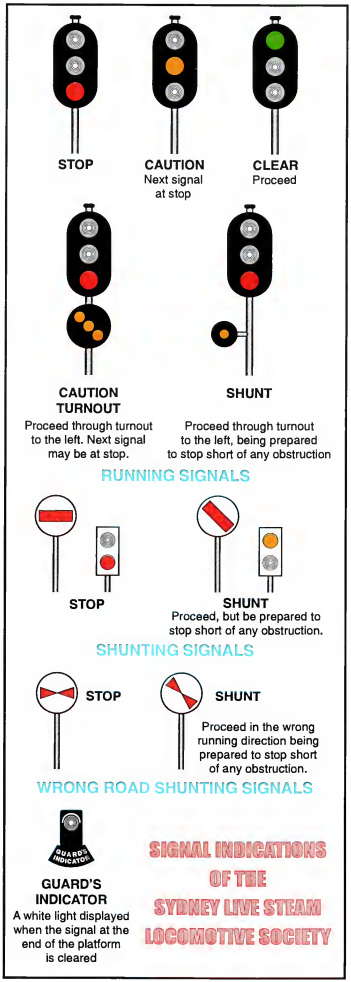
Reflectors are a nuisance, as they reflect light entering from the front and can give false indications. Drivers should not have to decide which lamp is on: it should be obvious. One way to achieve this is to use clear lenses with a coloured glass between the lens and the lamp so that the colour is only seen when the lamp is illuminated.

Placement of signals

In most of Australia — as in many other countries, particularly those with British based systems — the signals are placed on the left-hand side of the track, in the direction of running [there are a few exceptions in NSW where post-mounted signals are on the right-hand side where visibility is restricted... ed]. It is vital to be consistent in signal placement to ensure no confusion can occur where multiple tracks are in use; the driver always heeding those signals facing him on the left side. Where it is not possible to stand a post, a cantilevered structure or full signal bridge will be required. Only when there is absolutely no possibility of confusion should the signal be stood on the right hand side of the track. The signal head should be at about driver's eye level for post-mounted main line signals and the sighting should not be obstructed.

The track layout will largely determine where signals will be required. Signals can protect points, platforms and opposing movements. It would be logical to put a signal at facing points (to give a route indication); at the departure from platforms (which usually also protect points) and at all trailing point junctions where it is likely to hold trains clear of the points.

There is little value in putting mainline signals less than a train length apart. For complex junctions a rationalized approach would be



best, which would see the junction signal a distance back from the points, but with several turnout indications.

Try to ensure that trains held at signals do not hang back over junctions in their rear. This can unnecessarily restrict other movements. Remember also that when a signal displays a caution indication, the driver needs adequate distance to the stop signal to be able to pull up the train.

When a shunt signal is provided (for the wrong running direction) it should lead up to either another signal, or a shunting limit board and not allow the driver to go on forever!

Shunting yards should retain hand operation of points.

Interlocking principles

Interlocking is a critical part of the integrity of the system.

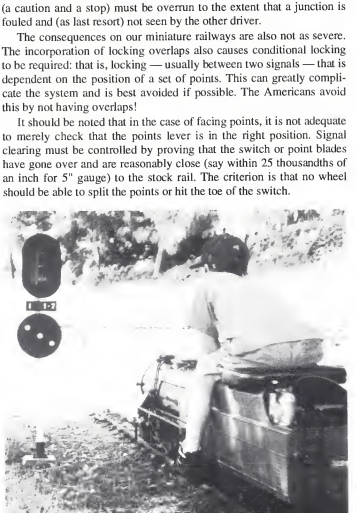
Before any signal is permitted to clear, the system should check that first all the points within the route (that is, up to the next signal) are in the correct position, and second that no opposing signal that would allow another train into the route has been cleared.

It is not necessary to check converging signals within the route, because if the points have been interlocked correctly, they would not be in the correct position to allow the converging signal to clear. They are, consequently, indirectly locked.

In full-size British based practice it is usual to lock points beyond the next signal to provide a safety overlap. On a miniature railway there is less need for this. For a risky situation to occur, two warning signals (a caution and a stop) must be overrun to the extent that a junction is fouled and (as last resort) not seen by the other driver.

The consequences on our miniature railways are also not as severe. The incorporation of locking overlaps also causes conditional locking to be required: that is, locking — usually between two signals — that is dependent on the position of a set of points. This can greatly complicate the system and is best avoided if possible. The Americans avoid this by not having overlaps!

It should be noted that in the case of facing points, it is not adequate to merely check that the points lever is in the right position. Signal clearing must be controlled by proving that the switch or point blades have gone over and are reasonably close (say within 25 thousandths of an inch for 5" gauge) to the stock rail. The criterion is that no wheel should be able to split the points or hit the toe of the switch.



Andrew Allison on V 1224 passes the home signal displaying a turnout indication.

A nice addition would be to ensure that once a signal has been cleared, it is back-locked: that is, operating or attempting to operate another lever does not cause it to return to stop. Similarly, accidentally operating a lever for a point through which a signal has already been cleared should not only not operate the points, but should also not affect the signal indication.

However, even with interlocking, should the signaller prematurely release the locking by putting the signal back after the engine has passed, the points could still be inadvertently pulled under the train. What is required is tracklocking, which holds the locking on the points whenever there is a train on them. This is to prevent derailments and damage to the points.

A subtle point (pardon the pun!) is that a cross-over is particularly susceptible to having the trailing end run through by a signaller returning the points prematurely, as the operator sweats on setting up another movement.

Some form of tracklocking is sensible on the mainline facing points and main line junctions; however, points used principally for shunting may not be as susceptible due to the greater vigilance provided by the signaller during shunts.

Documentation

Proper documentation is essential when planning the system and for installation and fault finding.

There should be a track plan showing the track layout and signals, platforms and positions of other major structures. All the points and signals should be numbered, the numbering being dependent on the control panel layout, and could take one of several schemes. Don't forget to leave spare numbers for future changes.

If you are using mechanical style levers, there are some simple rules that should be followed. Always configure your levers so that when setting up a through route, the levers are progressively pulled from the left. It's okay to miss some, but you should never have to pull a lever between two that are already reverse [see glossary on page 33 for this term... ed]. The order of the lever allocation should be consistent with the track layout as the signaller views it. Start with the left-most signal, then progressively number the main line signals through to the right. Then go back to the left and allocate each set of points a number. The signals leading through these should be the following signal numbers. If you have up and down main lines, the routes from right to left should be similarly allocated from the opposite end of the lever frame.

If you are using a push-button style panel, you will not be bound by these rules. It is still good practice to be consistent, and I recommend that you still number from the left to the right. Do the signals first. You can leave some spare numbers by making your "up" signals even numbers, and the "down" signals odd numbers. Then come back and number your points in a higher series of numbers.

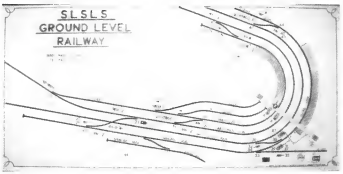
Interlocking or Control Tables are useful for working out the interlocking and cross checks. A typical control table is shown in the example on page 14. Once the interlocking for each item is worked out, go through the table and check that all have a converse by ticking them off as you go. (A converse always exists: e.g. If 1 locks 2; then 2 locks 1, which means that circuitry has to be provided in No.1 to check that 2 is normal and in No.2 to check that 1 is normal. In a mechanical lever frame it happens naturally!) This will ensure an error-free start.

Use standard conventions "normal" and "reverse." Normal is when signals are at red or points are lying in the position corresponding to the normal lever position. Signal levers found in mechanical type signal boxes are normal when back in the frame and reverse when pulled toward you.

Normal can be abbreviated to an "N" and Reverse to "R."

A good control table can be used for a direct translation into circuits, which should be fully drawn out before starting wiring. Any changes made during wiring should be marked up clearly so that at the end of construction a complete and accurate circuit book can be produced.

This, of course, is vital if anyone else other than the signal engineer is to have a ghost of a chance at fault finding!



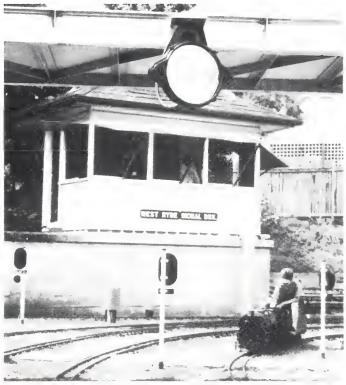
The signal box diagram showing the controlled area of the track layout with the point and signal numbers.

Photo: Brian Carter

Signal box facilities

All signal boxes should have a Box Diagram, showing the track layout, signals and numbering and major aspects of the systems such as platforms, bridges, etc.

Points should be shown in the "normal" position. For clarity, point numbers should be in black with signal numbers in red, these colours matching the operating levers if individual levers are used. Miscellaneous functions should be blue. A lot here will depend on the method of control to be employed, but whatever method is used, remember that a prototypical system is probably the best way to go, and will certainly result in a signal box that *looks* like a signal box and not a sound mixer or switchboard.



The signal box has a commanding view of the operating area. The full-size wrong road banner signal, from St Marys, hangs on the pedestrian bridge. The quarter scale single light signals control the main running

A view of the miniature Westinghouse type levers in use at the SLSLS at West Ryde. The black levers are for the points and the red levers are for signals. Behind the levers are the nameplates labeled with the lever name and function. The LED indicator and repeater lights are barely visible above the lever numbers.

Another view of the levers from the end of the frame.

Indicators should be provided to repeat back various functions so the signaller can monitor the system. These are essential in an all-electric signal box to ensure the equipment responds correctly to the lever movement. In many cases these indications allow problems and sometimes even potential problems to be pinpointed. Typical indications required would be:

- **Points:**
  a) Normal Indicator
  b) Reverse Indicator
  c) Lock or Free Indicator (to show when locking is applied with an electric installation)
  d) Transit Light (optional: to draw attention to a set of points that have lost detection).
- **Signals:**
  a) Reverse repeater.

Communications should not be forgotten, as nothing is worse than yelling instructions from one end of the grounds to the other. Telephones at critically placed locations, or a small handheld radio system (both of which are relatively cheap) would be essential to give smooth operation, improve the speed of decision making and give that overall air of quiet efficiency.

The signal box itself should have a commanding view of the interlocked area. Any points out of view may cause problems unless extra protection and sophistication is provided.

Circuitry and equipment

Circuitry can be split into two general areas. First, the components critical to the interlocking, reliability and safety of the system; and second, those components added to perform additional functions that may be required for operator indications or other reasons, but which are not critical.

Circuitry that falls into the first category should be designed to be fail-safe, simple and rugged for reliability. It includes circuits that operate and detect points, operate signals, and perform interlocking. Fail-safe operation can be accommodated by arranging that relays need to be energized to allow signals to clear or points to operate, and that the mechanical and electrical construction is of such a standard that short circuits, etc., are unlikely to occur.

Circuitry in the second category would include all forms of indications in the signal box, the emphasis being on reliability and ensuring that the system can continue to operate (although with less operator convenience) should a failure occur. In the event of a failure in either area, the system must be designed to draw the signaller's attention to the situation immediately.

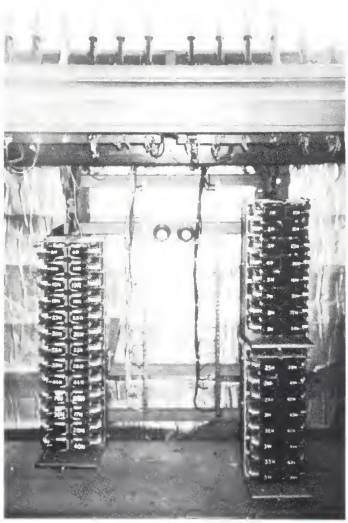
The basic functions required to operate the interlocking are:

a) Signal Normal

b) Points Normal and

c) Points Reverse

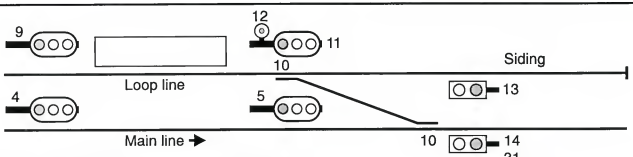
Multiple aspect signals will require a function for each different "proceed" aspect: that is, for a simple three aspect system, a caution function and a clear function. Additional functions would be required for signal replacement (that is, putting the signal to stop automatically when a train goes past) track circuiting, etc., depending on the degree of elaboration. Serious consideration should be given to this form of elaboration. It gives the signaller control over train movements (closely following trains cannot sneak through on an indication



Left: *The interlocking relays mounted within the signal lever frame. On the left are the point detector relays, on the right are the signal normal relays. All the basic interlocking is done between these two relay banks. In between the relay banks are the main positive and negative busbars. The earth fault detector lights can also be seen.*

Also mounted within the frame is the main terminal board where the internal wiring is interfaced to the external wiring. The multitude of power supplies are shown on the left. The LED indicator resistors are on the right. The circuit board that provides a flashing supply for the point transit lights is also visible.

A guard's indicator is fitted to suitable high location so the guard knows when the driver is able to proceed. This signal shows a white light when the driver's signal shows clear to proceed.
Photo: Brian Carter



Note that each route has a different lever number to avoid the need for conditional locking, and that every lock has its converse, for example: 4 locks 31, and 31 locks 4.

EXAMPLE OF CONTROL TABLES APPLICATION

CONTROL TABLES

SIGNAL	Requires Signals NORMAL	Requires Points NORMAL	REVERSE
4	31		
5	31	10	
9	13 14		
11	14		10
12	13	10	
13	9 12	10	
14	9 11		10
31	4 5	10	
POINTS	**Locked NORMAL by signals**	**Locked REVERSE by signals**	
10	5 12 13 31	11 14	

meant for the previous train), and virtually eliminates the necessity to throw a signal back to red in the face of a train, due to the signaller's oversight. Each movement is specifically controlled. Reclearing the signal is achieved by the simple action of restroking the lever (that is, putting it back and then pulling it again).

Signal replacement can be achieved by a relatively simple electronic circuit that detects the presence of trains (the trigger can be some insulated track or a trip wire attached to the sleeper that inputs into the electronics). Electronics is needed as a short trigger time with a fast moving train will not give time for reliable relay operation, and the electronics will operate much more quickly. One thing to watch though

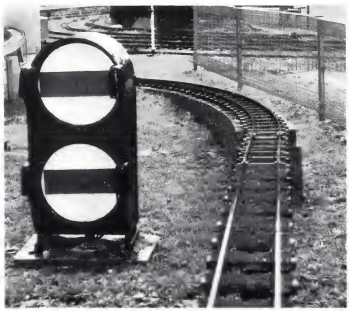
Signal number 46 has just returned to stop as Henry Spencer heads down the main line at the throttle of his Tasmanian Government Railways R class.

The signal has just returned to stop as John Hurst passes with a train of empty cars. Note the cantilevered signal structure.

is the presence of ground currents that occur during electrical storms. They can turn electronic components into soldering replacement exercises!

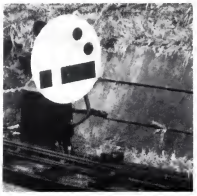
The construction of the system should be rationally laid out. All relays should be fitted into proper racks. Wiring should be neatly run, preferably in ducts, and terminated in terminals mounted on a suitable terminal board. All wiring must have wire numbers fitted at each termination for identification and all relays should be labelled. A good system would incorporate the function number or name as part of the labelling for ready identification.

Equipment housed outside should be suitably protected from both rain, floods or, hardest of the lot, condensation.



This twin banner signal protects the main line from the SLSLS ground level locomotive servicing facility. This particular unit spent its prototype career in the Hornsby yards.
Photo: Brian Carter

Even the elevated section of the SLSLS is treated to an operating signal system. In this instance the only known example of a NSWGR ten lever G type ground frame. The levers are fully interlocked and operate the south points and the lower quadrant signal. The signal is from West Ryde's "old back road".



This Relph Disk signal is possibly the only working example left. After completing its full-size service at St Marys NSW, it is now protecting the elevated main line from the elevated loco service facility.
Photo: Brian Carter

Glossary

Aspects: The [illegible] of the indications given by a signal, [illegible] stop, [illegible] caution, clear, etc.

Axle Counter: A device for counting axles as the train passes.

Conditional (locking): A situation where two functions interlock with each other only when a third function is in a certain position.

Fail Safe: [illegible] ensures that a failure will always result in a safe situation.

Indication: The [illegible] displayed by a particular aspect, e.g. a red light.

Interlocking: Any [illegible] that prevents the clearing of a signal [illegible] conflicts with the [illegible] points or another signal [illegible] already cleared.

Lock or Interlock: A device [illegible] mechanical or electrical, that serves to [illegible] operation of another function, e.g. a relay contact [illegible] circuit.

Normal: Signal: When it is at stop.
Points: A condition [illegible] for the main or straight route.
Lever: When it is [illegible] away from you) in the lever [illegible].

Overlap: A [illegible] safety section provided beyond a stop signal.

Points (Switches): Moveable [illegible] inside fixed rails which [illegible] a signal [illegible] separate lines. Used to switch [illegible] in the desired direction. The hinged end of the moving blades is termed the "heel", and the [illegible] movable end the "toe". When the toe faces traffic the points are termed "facing". When trains pass over the back [illegible] of the points first they are "trailing".

Proceed (indication): Any indication given by a signal except stop.

Repeater: A light or device that gives an indication identical to that given to the signaller as to the state of the signal.

Reverse: *Signal*: When it has been cleared to any aspect.
Points: When in the opposite position to normal.
Lever: When pulled toward you.

Shunting Signal: A form of signal used for shunting where the route may be occupied.

Signal: A device for conveying information to the driver as to the route which is set by a system of lights using coloured discs or position.

Signaller: Signal operator.

Token System: A system of safeworking between two [illegible] areas that relies on the possession of a token as an authority to occupy the section.

Track Circuit: An electrical device that uses the running rails to detect the presence of a train.

Trackblocking: An arrangement where the basic [illegible] are maintained by the positions of trains.

Turnout: Synonymous with point.

Automotive-type cable would be a minimum size for outside runs. This ensures a robust cable with minimal voltage drop problems (depending of course on the length and current draw). The cable should be buried and provided with protection such as fibro or metal strips or other means. 150 mm would be a minimum depth with a protective cover, but go as deep as you can given the type of soil.

Wires under tracks or roads should be given additional protection, such as conduit, if it is not possible to go to a reasonable depth.

In laying out a major cable run, try to ensure that all the wires are buried for all the functions required, and include some spares. Trenching is a major job and not pleasant when having to re-lay more wires along a route where cable exists, particularly as damage to the existing wires is almost inevitable no matter how careful you seem to be.

Make sure all cable runs are properly documented on a cable plan. This should show the tracks, structures and cable route with critical dimensions: as the human memory is hopeless two years on, particularly as most structures on miniature railways are always on the move!

Automatic signalling

The foregoing has discussed signalling at junctions (the interlocked area). But what about that expanse of straight track as you head out into the paddock? It is an attractive idea to a techno-buff to signal this for train separation and show some pretty lights to the drivers. But beware! Unless designed so that a "proceed" indication can never be given into an occupied section, then at some time someone will experience a clear signal into the rear of a train. From then on the system will have a bad name and will be useless for train running. Systems that rely on trains putting the signal back through a short insulated track section next to the signal, and then reclearing it after occupancy of a similar section at the next signal, suffer from this problem. It only needs a train to pass a signal at red to have two trains in the section. The first out clears the signal behind and sets up a potential disaster for the next unsuspecting driver.

I can only see two ways of providing a system that works. The first is to provide a track circuit in which the wheels of the train short circuit the rails to give train detection. This of course is only possible on track constructed so that the rails are insulated from each other. The second method is to count the axles into and out of the section. This method would need to use proximity devices and some fancy electronics. Reliability would be paramount and, I suspect, difficult to achieve with a simple arrangement. Ensuring the system could cope with a reversing train would be an additional challenge.

Track circuiting is clearly the easiest and most reliable, although the use of a simple relay (as in full size) would be dependent on the cleanliness of the rails. Electronic systems could be used to detect a shunt of higher resistance, although I have never actually had a need to develop this.

If you use all-welded track, the simplest solution is to use tramway working in the section. Or on single track, try a token system!

A Winter Weekend in Windy Wollongong

by Ross Edmondson

Over the Queen's Birthday weekend in June 1995, the Illawarra Live Steamers staged the Innaugural Hot-Pot run. Although a few novelty events planned, the weather had other ideas. Saturday dawned overcast, bleak and cold and it remained this way most of the weekend. In the early afternoon it was raining enough for those who were running to call it a day. It's often been said that no matter how much organising you do and the lengths that you go to to organise a "you-beaut" weekend, one thing we have no control over is the *weather*. Perfect for a Winter run!

The Hot-Pot

A condition of entry was that everyone who came was to provide one can of soup. The idea being that they would all go into the one pot — not all at once — with one of our members looking after it from time to time. The pot was to remain on simmer for the duration of the weekend and the club would provide the buns and the butter.

Mightn't sound very tempting but for one fleeting moment just let your imagination run wild and visualise the following all in the same pot: Vegetable, Big Red Tomato, Chicken Macaroni, Pumpkin, Creme of Chicken, Tomato and Bacon, Vegetable and Beef, Garden Vegetable, Minestrone, Creme of Pumpkin plus a few others that slipped past. The only complaint I heard was when the buns run out and this was soon rectified. Let's be honest, if your wife dished this lot up to you, you would no doubt throw it at her, or question her sanity, but from all reports filtering back via the grapevine it was a big hit all round, even the English fraternity, within our ranks, rated it as *smashing!*

Those who dared!

Over the weekend visitors came from far and near with a good contingent from the Edgeworth Society and the guy who won the prize for coming the furthest went to Bob White who hails from Queensland representing the QSMEE Society. Over the weekend there were 34 loco's in action with five goods trains on the go. A total of 79 goods wagons were hauled from one end of the track to the other and back again. Several other visitors were having a great time amusing themselves with the signaller routing the trains all over the network, attempting to confuse the drivers completely.

The motive power

There were six C36 class loco's, two D59s, two Tender S class, one C38, one 12 class plus a variety of freelance locos including Simplex, Maid of Kent, Netta, Hunslett and others.

More wind!

During the night the westerly winds came hurtling over the escarpment some two months ahead of schedule and talk about *blow*! Early on Sunday morning a large gum tree adjacent to the station decided to call it quits and came crashing to the ground, blocking the road. Fortunately, it fell across the roadway and not all over our new station... phew! A tree near the southern signal box also gave up the ghost. The winds persisted all day much to the dismay of the visitors until it got to the dangerous stage when a unanimous decision was reached to call the day off.

During Monday the winds persisted, although not as bad as the previous day. This ensured that quite a few locos kept running with everyone having a grand time.

Next year

Several of the visitors have requested to stage this event again next year and I cannot see any reason not to. I believe some of the regulars have already booked in anticipation that the windy weather will not repeat itself. Watch the pages of this trusty Journal as the time draws nearer to the date.

Of course, the condition of entry still applies... one can of soup per person!

Shop Hints of Peter Dawes

1 A Drill Column Swarf Guard

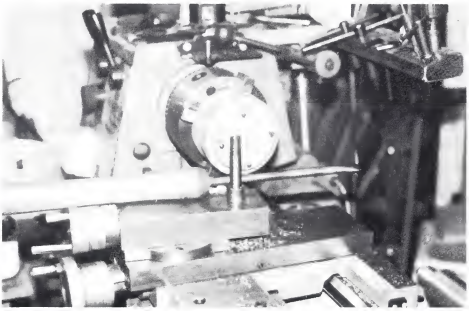
That vee-groove at the bottom of the column on drills and mills, which supports and guides the bottom end of the rack, invariably collects rubbish, the more so because it must contain grease. The simplest cover is a flat disc fitting closely around the column. Next best is to find a tin lid that will fit over the outside diameter of the base. Alternatively, cut a circle of tin-plate and solder and/or pop rivet a suitable narrow rim around it. Or best of all, spin a disc of annealed aluminium or brass over a simple wooden former. This is how I made one.

Metal spinning

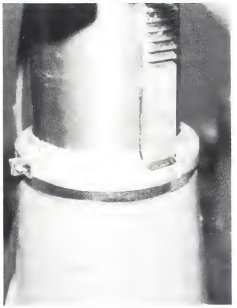
Cut a rebate around the end of the former to create a boss the same diameter as the column and about 10 - 13 mm (⅜"-½") long. Spinning the metal into this will produce a "polo neck". Round all corners off slightly. This polo neck is somewhat harder to spin because it involves a concave corner, so if you find it difficult, leave the centre flat and just spin the outer convex corner to make the rim or skirt, which is more important.

The metal spinning wooden former.

The disc can be held against the former for spinning by heavy pressure from a tailstock ball bearing centre, or it can be attached with four small screws into the end of the boss. This is okay because this centre piece is later cut off. Either way, the blank will have to be removed periodically for re-annealing. Heat and quench the same as copper — but not as hot, or you will melt it.



The metal spinning set-up. The wooden former is in the chuck. Note the four screws used to hold the disc in place. The tool post stud is used as a fulcrum for the special spinning tool.



The swarf guard fitted in place. Note the small assembly brackets on the left.

Finish off

When the spinning is finished, carefully trim the skirt straight then part it off around the top of the polo neck, using the vee-pointed spinning tool or a pointed lathe tool with negative rake. Leave it in the work-hardened state this time.

If not being spun, mark the centre of the disc, centre punch it lightly, and scribe a circle the diameter of the column. Cut out the centre.

If you are energetic or have a hoist, the column can be removed from the machine base to install the cover, but it will be easier to split the cover and rivet small brackets to the cut ends of the skirt. Drill them for a 3mm (⅛") bolt and nut.

Cut a notch for the rack in the column opening so that the join will be around the back, out of the way, when the rack is in its normal position. Make the notch with the same dimensions as the cross-section of the rack, plus a small clearance. The surplus metal in the notch can be folded over to take the sharpness off the three inside edges of the notch.

Assembly

Finally, bend or spring the two ends apart to fit it around the column. Put the small bolt and nut through the brackets to bring the ends together. It should remain loose, resting on the top of the base ring and rotating with the rack as the table is rotated. Just lift it up to grease the groove.

Making Printed Circuit Boards

Story and photos

by Bruce Allen

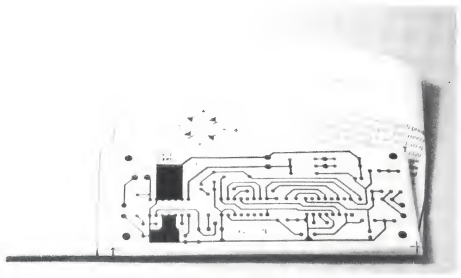
Bruce describes a method of producing printed circuit boards using a simple technique. Students in his high school electronics classes use it with a high rate of success.

There is no way out of it. Electronics has impacted greatly on our hobby of model engineering. As many of our societies actually have the word "experimental" in their titles, here is a field where this can be carried on. Indeed, we hear so often of the need to attract younger members. Here is a field wide open to the younger ones with their interests and abilities in this area. Many of the specialist electronics magazines regularly publish circuits which could be modified to suit our purposes.

AME July-August 1995 had just such a circuit. This was the Diesel Sound Simulator for the 5" gauge 422 class locomotive under construction. I figured that this would be an appropriate time to share my method of making boards to published designs. Obviously some of the more complicated boards will be more difficult to do but general run of the mill boards can be made.

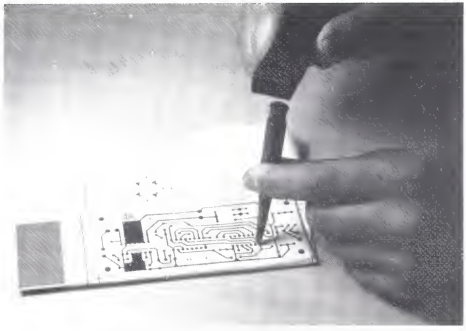
Setting up

All the materials are readily obtainable from regular suppliers. These will be mentioned in the course of this article. When considering the costs of these materials remember that much of it is on a once-off basis. The chemicals can be stored for later use. Maybe a couple of you could go in together to share the costs. Once set up, these are peanuts anyway.



The virgin board wrapped in the photocopy of the required artwork.

Unless you want your AME magazine look like the mice have been at it, firstly make a photocopy of the circuit. Printed circuit board comes with a thin coating of copper on a backing of epoxy reinforced with glass. A suitable piece can be obtained from Dick Smith Electronics. The following prices and catalogue numbers are from their 1995/96 catalogue. For one board H5540 is 150mm x 74mm and costs $2.75. This will give you enough for one board. The next size up is 150mm x 150mm (H5545), costs $4.95 but is enough for three boards. The board needs to be scrupulously clean. A household Scotch-brite® type plastic scourer and Ajax® powder from the domestic supply is suitable here. Make sure that you remove all tarnish, finger marks etc. Rinse thoroughly under running water and allow to dry. From this stage avoid touching the surface. Pick it up by the edges.



Marking the positions of all holes with a light centre punch.

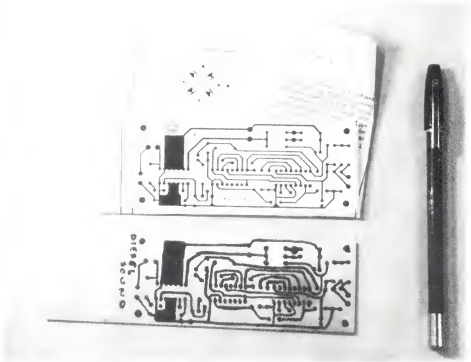
The method

Fold the photocopy of the circuit so that the board will fit inside as shown in the photograph. Use a light centrepunch and an extremely light touch, make a dot through every pad. The next step is to remove the board and play join-the-dots. This is done using a direct etch pen (N5181) costing $7.95 each. This contains a lacquer based ink which is used as a resist in the etching process. The pen works by pushing the fibre tip in which releases a small quantity of the ink to the tip. Be careful doing this on the actual board as sometimes flooding occurs. I would suggest that this be done on the large area under the LM380 chip (IC3).

The first thing to do is to form the pads where the components will be soldered. The trick with these boards is to put on maximum size of pad for soldering while not allowing them to touch, forming a short circuit on the board later. If a small join occurs where you do not want it, allow the ink to dry and scratch out the offending bit with a scriber. Carefully join the dots so formed, going very carefully so that the tracks do not overlap. If they do, revert to the scriber technique. Check the board very carefully to make sure that all the tracks are there, actually join up, and do not overlap. This is most important as this is where most of the troubles with any circuit will occur.

It is now time to etch the board to remove the unwanted copper. Ferric chloride is available N5652 at $14.95 for a 500ml bottle. This is reusable and will etch a lot of boards. As this is a highly corrosive substance be sure to read carefully the instructions on the bottle. As a small etching tank use a plastic ice cream container. This can be disposed of after the ferric chloride is returned to the bottle on completion of the etching.

Drill a small hole in the corner of the board and tie on a piece of insulated electrical wire. Move the board in the etchant to keep the liquid flowing over the surface. Check every few minutes to see how things are progress-



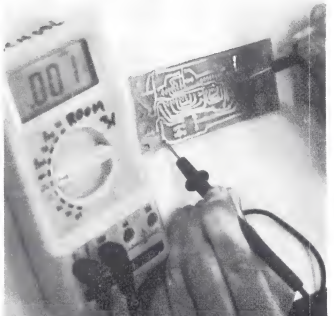
The Printed Circuit Board (PCB) with all pads and tracks drawn on it with the laquer resist pen.

A handy tool to separate joined tracks.

ing. If part of a track is showing signs of being eaten by ferric chloride, remove the board, rinse off under running water and touch up the offending spot with the pen.

When dry carry on with the etching. The process is completed when all of the exposed copper has been eaten away.

Wash the board under water. Clean the board back to clean copper with the scourer and Ajax. If you are having trouble with spots of pen in the centre pop marks, use a solvent cleaner like methylated spirit. The board needs protecting so that the copper does not get tarnished again. If this happens soldering can be difficult as the solder will not stick properly to the dirty copper. Here is the second most likely cause of a circuit board not working. This is known as a dry joint, may look like a miniature onion in extreme cases and be an infuriatingly difficult fault to trace. The clean copper can be protected by spraying with clear protective lacquer, N1130 at $16.50 per 200ml spray can. An alternative is shellac at about $2.50 per 500g m from a hardware store. Mix a small amount with two or three times the volume of methylated spirit. When this is painted on and allowed to dry it not only protects the copper but also acts as a flux to assist the soldering.



Use a multimeter to test all tracks for continuity (ie. breaks) and for short circuits between tracks.

Careful checking of the board is necessary to ensure the quality. Use some sort of continuity tester to check that the tracks are intact from end to end. It is also wise to check each track that there is *no* continuity to the next track where it is not supposed to be.

Lastly drill the holes 0.8mm in diameter. Unless you have a special small drilling machine such as a Dremel®, holding a drill this size will be almost impossible. A useful dodge here was published in this magazine some time ago. Simply wind some light resin core solder evenly around the shank to build up the size.

Fixing Boo Boos

The board that I produced to illustrate this article was done during class time. It was simply left unattended in the pickle tank. At the end of the period some of the etch pen had been scratched off and a couple of broken tracks occurred. These were fixed by soldering a small piece of copper wire across the break. These can be seen in the photograph. The other problem that can occur is that when small bridges join adjacent tracks. The best tool that I have found is a broken piece of hacksaw blade sharpened on the end so that the teeth are like a serrated knife. The photograph shows the details.

Another fault that can occur on the board is when a hole is drilled slightly out of position. With the resistors and capacitors there is a little room for error. With the sockets and ICs it is a different matter. These are on a pitch of 2.5mm apart. If the hole is up to "half a hole" out of position a fine pointer can be used to encourage the pin to fit. Any more can have the pin bending a bit too much.

To fix the holes more than half a hole out fit the socket into the holes that do line up. Carefully push the socket into these holes, allowing the pins that do not line up to pop out of the socket. Remove these with a pair of needle nosed pliers. Position the drill in the socket hole recently vacated by the pin and use the hole in the socket as a guide to drilling the hole in the board. Replace the pins and proceed as though nothing had happened.

Lastly

While the method described here may not produce a professional looking board, with care a working kit can be produced. Once again, as with most things as your skill level improves so will your boards. Remember that even though most of us are keen on steam powered models, the future will definitely be more electronic.

Part Requirements

Number Reqd.	Item Description	D. Smith Catalogue
1	Printed Circuit Board	H-5540
1	Direct Etch Pen	N-5181
1	500ml Bottle of Ferric Chloride	N-5652
1	200ml Clear Protective Laquer	N-1130

Sand Cast Metal Founding for the Model Engineer

A practical series by Bob White

Part 2 — Continues with Patternmaking

Drawings for publication by Peter Kerville and photos by Bob White

Following on from Part 1 of this series on patternmaking i.e. "The Initial Considerations", where we selected the joint line, decided on a loose or plated pattern and the need or otherwise for using cores, we now arrive at the next step in the decision making process.

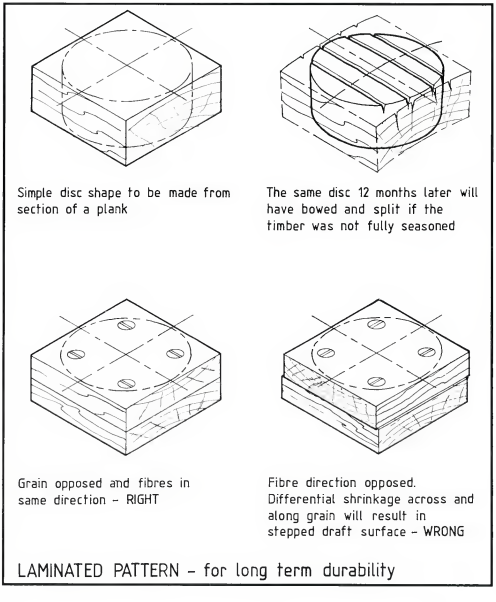
Choice of materials

There are many elements that dictate the choice of materials for construction of patterns. We shall discuss those relevent to our hobby, giving consideration to their durability, the expected number of times they will be used and the foundry requirements.

Life expectancy

Not yours, the pattern's! That is, will it only be required for one-off and never be needed again. For example, if a simple disc shape is required, the pattern need only be made up on the disc sander direct from timber cut from a plank and it will be of no consequence if three months after completion it develops cracks and a distinct bow as the timber continues to season.

If, on the other hand, the job will have a couple more made off again next year for a friend and maybe the same again a year or two later, then the timber blank should be laminated as shown in the sketch. If the work is to be extensively turned, even for one-off, the time taken to cut out and glue up segments for the blank as illustrated will be returned by way of workability gained in not having to contend with the end grain.



Number of moulds to be made off the pattern

If the shape is reasonably bulky and hence structurally strong, numbers of up to 1000 moulds can be made from timber tooling if given a little maintenance along the way. Conversely, should the shape be very delicate, it may well be easier to make the pattern from metal even for a one off casting. Metal of course is used very much in industry for production patterns due to its structural strength and resistance to sand abrasion. A wooden master is often made up, cast in metal, then filed or machined and mounted on a metal plate.

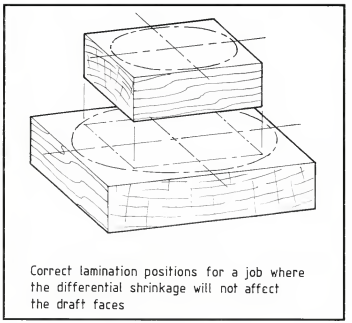
Complexity of the shape

This may dictate that epoxy resin would be the best choice even for our small numbers. A good example of this is for a complex corebox. These inside out creations are often far easier to produce by first making the male form, i.e. the shape of the core, in timber and then back-pouring in epoxy or even plaster to create the female version corebox.

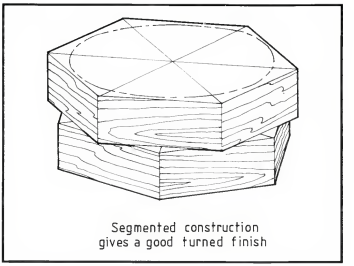
Epoxy is also good for creating mating contoured joint lines on pattern plates. It is a one-on-one process hence creating perfect matching surfaces just as in the production of a set of false teeth.

Would a sample casting do for a pattern?

Some times yes, but it would need some work done on it first. Draft is the prime requirement. That is, we have to be able to get it out of the sand. Bog is the best medium to use for filling undercuts and coarse sand cast surfaces in the sample casting while filing can be used to reduce fine sand cast finishes to a common flat plane. Make sure that the file marks do not wind up deeper than the original sand cast marks were though. So, if you are considering borrowing a sample casting to use as a pattern, make sure the owner won't mind it being returned coated in bog, covered in file marks and rubbed all over with plumbago and kerosene which has been applied by the moulder to help it slip from



Correct lamination positions for a job where the differential shrinkage will not affect the draft faces



Segmented construction gives a good turned finish

Segmented laminations are best for turned shapes as the grain can be arranged to lie in the circumferential direction so that no end grain is presented to the turning chisel.

the sand.

Machining allowances can be added to the sample by bogging on pieces of thin ply and core prints can be added in timber. Cores of a simple shape, can be hand filed from block core or, indeed a complete core box may have to be made from scratch.

If the sample is broken, tack weld it together in a few spots to secure the shape. On larger items, contraction may have to be taken into account. Sometimes contraction allowance can be gained by welding broken pieces back together again a little further apart than where they came from originally or, by adding timber or bog extensions to critical extremities.

Pattern materials — properties and uses

There are many materials from which patterns can be made. I shall expand on those which are most relevent to the model engineer.

Timber

This is the main working medium for the Engineering Patternmaker for it is relatively inexpensive, quick and easy to work with both by hand and machine. Timbers suitable for pattern work must be well seasoned for stability and to readily take glue, bog and paint. They must be fairly soft for ease of workability and have fine, close and straight grained fibres. This is to give a fine surface finish when planed with the grain and when sawn or chiseled across the grain. They must also be close grained, so as not to split easily with the spreading force of nails and screws, even though finer gauges are used for pattern work than are used for general timber work.

Jelutong and Milky Pine from the Philippines are common timbers used in industry for extensively worked shapes while Australian Hoop and Kauri Pines are sometimes used for more structural members and hard wearing surfaces of the pattern where workability across the grain takes second place.

Meranti, (or Malayan Maple in the vernacular), is one of the most readily obtainable softwoods for the amateur. However, like our own Silky Oak, although very stable and resistant to nail splitting, is very poor when trying to plane a smooth as glass surface or to saw and chisel across the grain. It has the character of exhibiting a texture of dimples when dressed along the grain and of fibre tearing from the saw across the grain while chisel working across the grain leaves a myriad of large pin holes which are the gaps between the coarse fibres. In other words don't attempt to use it for pattern work.

For supplies of timber you could first try your local timber yard, joiner, cabinet maker or furniture maker, explaining the properties you are looking for, especially highlighting the need to be able to work the end grain by both chisel and sanding disc. If no joy there it would be best to make the effort to get in touch with your nearest Engineering Patternmaker. His off-cut pile would give you enough material for a lifetime of model engineering! Take along a couple of photos of your work and a copy of AME to show what you do for a hobby. I guarantee he will take the time out to talk to somebody who works with their hands for leisure. Be prepared to pay whatever price he asks of you, for it will be cheap for the quality and workability of the timber you will bring home.

Laminates and composites

Marine Grade is the only type of plywood I would consider for our fine work. It is on top of the price list but way ahead of the next best "Waterproof", and this is as low as I would drop in quality for pattern plates and core boxes. Do not even consider Melamine Ply (concrete form ply) for its plastic coating makes layout work impossible.

Marine ply is made from very workable timbers in all veneer laminations and does not have those annoying gaps between internal veneers so common in other plys. Only a cou-

A pair of single sided plates for a truck brake spider. Ribbed back plates are cast in ductile iron. Extensively contoured joint and pattern surfaces are back-poured in epoxy resin.

Above: Aluminium signal quadrant pattern next to a window frame pattern fabricated from brass sections soft soldered together.
***Right:** Loco trailing truck, lettering patterns again from metal sections*

ple of thicknesscs in small sheet sizes would be all you need as thicker sections can be glued up from combinations of these.

Another prime reason for the use of marine grade, is that ply is often used as a backbone to construct some shapes on and in this role inevitably winds up with a laminated edge showing on a draw face where a smooth and stable surface is paramount.

Fine textured, dense structured chipboard composites like "Customwood" that have been designed for planing and routing are sometimes used by pattern makers for one off jobs of bulky, very simple, geometric shapes. They can be bandsawn, sanded and chiseled easily and will hold a good finish for draft for a few months before surface finish deterioration. Again a few offcuts would be useful but it is worth remembering that this material offers very little purchase for nails or screws and subsequently the moulders rapping come draw spike.

Metals

Both Aluminium and Brass in sheets and plates are very useful for our work. Araldite, solder and bog can be used to hold sections together to form intricate shapes that would be difficult to produce with any strength in timber in such small shapes as ours.

The photo at the top of this page shows a model railway signal quadrant pattern made from aluminium sheet sections glued together and a brake van window frame pattern made from brass sheet sections soft soldered together.

These metals are also useful for making special lettering from such as the SKF shown in the trailing truck axle box close up photo at the top right of this page.

Epoxy resin and glass fibre

These play a very big part in industrial patterns as they are good for multiple reproduction off a wooden master pattern and offer a very abrasion resistant surface to the sand. However, they are very expensive. Ciba-Geigy have the lions share of the market but other brands with small pack sizes more suited to our requirement are available and you would be best to look up "Pattern Makers Supplies" in your Yellow Pages for a source.

Rubber

This is sometimes used as a mould for producing small epoxy resin patterns from as it is flexible and makes for easy stripping of a delicate epoxy shape. It is available as a two part pack from Epirez, who are listed in all capital city phone books and who can also supply epoxy resins.

Plaster of Paris

This is useful for simple contoured core boxes in small work and is available from large hardware suppliers to the building industry plaster trade. Its disadvantages are proneness to small air bubble entrapment on the work face, a very short working time and an extremely slow drying out time. The moisture from the plaster tends to be absorbed by wooden patterns subsequently swelling them and making removal difficult. Teased out rope fibres can be added into the back of the work to provide reinforcing.

Polystyrene foam

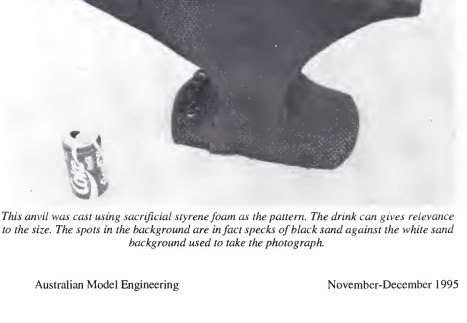
Three forms of foam patterns are used by industry and all consume the pattern upon pouring the mould.

In the first, the pattern is made by hand cutting and gluing up the shape of the job to be cast without any consideration for tapers or undercuts. This is then rammed up in the sand often with a styrene runner and riser system as well. The second and third forms both use an injection moulded pattern complete with often complex internal shapes such as a car manifold or a large pipeline stop cock body. One process involves burying this pattern in a free flowing sand bed to form a mould and the other invests the pattern in a refractory ceramic coating just as in lost wax work.

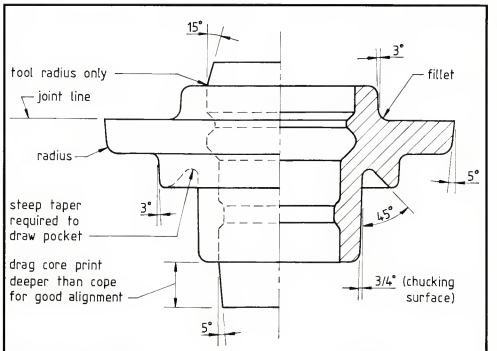
In all three variations the liquid metal is poured onto the styrene pattern causing it to vaporise and vacate the mould cavity as a gas enabling the liquid metal to flow into its place. The first method is quite suitable for the amateur working in green sand, but a word of warning! Copiously vent the mould and pour the metal slowly. A safer way still is to make the mould in chemically bonded sand and burn out the styrene with a gas torch before casting. The photo below shows a steel anvil recently cast in my own works by this method.

Bog

The generic name patternmakers give to all



This anvil was cast using sacrificial styrene foam as the pattern. The drink can gives relevance to the size. The spots in the background are in fact specks of black sand against the white sand background used to take the photograph.



TYPICAL HUB CASTING

epoxy fillers. It is used for fillets, filling screw holes and all other manner of imperfections. It should only be mixed in small amounts at a time as it is quick setting and avoid working with it in the heat of the day as this accelerates the setting time. It is best chiseled and scraped when just cured but sanded when fully cured for otherwise it loves clogging sand paper.

Glueing the patterns

PVC glue is ideal for it takes well to dry timbers and is easy to paint, plane, chisel and sand.

Pattern paints

It is hard to beat automotive undercoats for this work as they are designed to fill surface imperfections. Glossy enamel finishes are not required for we don't need a shiny surface but rather one free from any sign of the wood pores on draw faces. Auto undercoat is easily thinned to the consistency of enamel for brush application and dries in half an hour or so ready for sanding and recoating.

A word about colours. If you are to be both pattern maker and moulder, the pattern can be the same colour all over. If somebody else is to mould it you could paint the core prints in a lighter colour for better clarification. Say automotive undercoat red for the patterns and grey for the prints. In the days of yesteryear when time was not so valuable, a code existed for pattern colours. There were separate colours for each metal, for coreprints and for machined surfaces.

Abrasive papers

Wet and Dry papers (used dry) are excellent for bare timber, bog and painted surfaces. 80 and 150 or 220 grades would suffice for coarse and fine work respectively.

Terminology

As with any other specialist trade and profession, the pattermaker and founder have developed a lot of terms specific to the work. So before I move on, it may be best for us to become familiar with the terminology of the pattermaker and founder. The drawing of the Typcal Hub Casting (above) demonstrates some of the terms and typical values used.

Draft or taper

Should I apply moulders taper or pattern makers taper? The argument over tapers has raged for centuries and will continue to do so for it all works as follows:

The theory

The Engineer or Draftsman draws up the shape he wants made and as he does not fully understand the mysteries of the moulders art and won't ask anybody for help for fear of being shown up as being less knowledgeable than he makes out he is. So he simply goes ahead and draws the job up without any tapers. The pattern maker then has to work from this drawing and while not knowing the exact function of the finished casting and not being game to ask, elects to play it safe and apply the least possible taper everywhere. Hence we have "Pattern Makers Taper".

The buck stops with the moulder for he is the one who has to get the damn thing out of the sand, firstly without breaking away his mould and secondly without wrecking the pattern. I have often seen a moulder, after losing several moulds and in sheer (pardon the pun) desperation, take the pattern over to the fettling shop and rip another quarter of an inch of taper off it on the big snagging grinder. Hence, "Moulders Taper".

Let's get practical

When more than one party is involved and there is a possibility that somebody is not sure, discuss the job with all involved. I would rather have my head bitten of for asking a question than for causing a stuff up any day.

Tapers in a nut shell boil down to applying the largest possible without detracting from the function and appearance of the end casting. Remember, function also includes the registration and chucking surfaces required for machining, so the machinist should be in on the discussion also. He may want to chuck on a surface that has been given five degrees or more taper or may have to register in a jig right where the moulder has cut in a gate or riser. Of course when one wears all these hats the principle is still the same i.e. think the job right through before you start.

Now for a few rules. Tapers right at the joint line on shallow draws should be large, say anywhere from 5 to 15 degrees. This is because shallow draws do not have the guidance provided by a deep pattern.

The shallow draw pattern tends to tilt easily when being drawn and in doing so chips the mould edges. General purpose tapers should average around 3 degrees. If taper must be lower than this, say for security of chucking, then it can be dropped right back to three quarters or even half a degree but keep such small tapers confined to only the surfaces that must carry them for remember they add to the frustration of the moulder and the time he takes to do the job.

Pockets must be given plenty of taper at least on one face with the angle dependant on the degree of confinement and depth of pocket.

Core Prints should have liberal tapers with three degrees being the very minimum, not so much for drawing the pattern but rather for both drawing the core from it's box and for guidance when placing it in the mould.

All angles quoted are per side i.e. they are not inclusive angles when applied to diameters.

Fillets and radii

What are they and why have them?

Fillets

Fillets are the small radii placed in all the internal corners of the pattern, that is they create concave surfaces in all the casting internal corners. The first reasons for fillets are to remove the sharp corners from the mould which tend to chip and crumble away while moulding and to wash away under the impact of the inflowing liquid metal.

An even more important reason for fillets is to reduce the surface area of sand exposed

to radiant heat in projecting corners of the mould. The sand in a sharp corner will reach a far higher temperature than the more regular surface s of the mould and so during solidification will delay the freezing of this concave corner of the casting. This then provides a site for a shrinkage defect or, in metals with high shrinkage rates, a hot tear. In the lower shrinkage rate metals it can produce a "burn in" where liquid metal penetrates into the sand matrix and fuses into one hard silicate/metal mess.

Radii

These are the rounded off external corners of the pattern, (with the exception of core prints) which in turn generate convex surfaces on the casting. Their use is generally aesthetic but some reasons are important. They make the pattern less vulnerable to damage for sharp corners are easily bruised and will then leave a drag mark all the way up the adjacent draw face of the mould. They also reduce the chance of the mould or core especially, developing a fracture propagating from the sharp corner.

Finally, they add to the appearance and safe handling of the finished casting just as chamfers do on machined work.

Contraction

The term applied to the reduction in casting size that takes place between solidification and ambient temperature. It is the amount the pattern maker has to add to all dimensions to ensure the casting will finish up back at drawing size when it cools to room temperature. Contraction is expressed in inches per foot in imperial terms or in percent in metric terms.

Contraction allowances for some common metals are, Aluminium and Bronze, 1.3% Grey Iron, 1% Ductile Iron, 0.5% and Steel, 2% Contraction rules are available which already have the allowance built into the graduated scale These can be bought in lengths ranging from 150mm to 2 metres from pattern makers suppliers.

My first introduction to contraction rules was as a young apprentice. I had been delegated to machine a part for some pattern equipment tooling to a standard rule dimension. For some reason the work finished up too big and with fallen face I presented it to the supervising pattern maker.

My incorrect workpiece must have been of no consequence for he looked at me with a wry smile and said, "Don't worry, we have rules for jobs like this." Where upon he produced a rule that showed my workpiece to be the correct size!

Next?

In the next issue we will don an apron and get out the tools.

To be continued ...

Painting Brass

by Ross Edmondson

Some time ago an old model engineering friend passed on to me a "secret recipe" used in conjunction for painting brass and as I have had startling results with it's use where the paint has 'stuck' to the loco for over ten years and I feel that it is now time to divulge this 'secret' to other model engineers.

Actually it's not much of a recipe, all you have to do is to dissolve as much 'napthalene flake' as possible in methylated spirit.

For openers, napthalene flake is the stuff your wife puts in the wardrobe to get rid of the silverfish and is a bit on the bugle and what I used is an empty wine flagon (the hard part is to get it empty) into which I put about two cupfuls of napthalene flake and then filled it with the methylated spirit. In order to get the flake to properly dissolve, sit the brew on the end of the bench for a month and every time you go past it, give it a shake or two just to stir it up. A certain amount will dissolve into the metho and the rest will sit in the bottom of the flagon. After a period of time the flake will go hard but don't worry the dissolved mixture will be okay. If you wish to get the hard bit out at a later stage it can be broken up with a screwdriver or other long instrument.

As most model engineers know, the handling of brass quickly tarnishes the lovely bright surface into something dull and lifeless. Whether it be tender sides, cab sides, or boiler lagging. Once you have finished the part I sand blasted mine with normal dry beach sand. Now don't despair, if you do the job properly you won't damage the finished project and not only does the sand blasting get rid of the 'crud' and anything else that it has picked up along the way during manufacture but it will actually improve the surface (similar to a very fine sandpaper) which will give the paint something to hang onto! As you will only require a small amount of the 'magic potion' for your job, pour sufficient into a clean fruit tin or jar. With the workpiece now sandblasted and ready to go please don't go and pick it up with your grubby hands... use a piece of clean soft cloth and with a nice clean paintbrush brush some of this 'soup' onto the job. The methylated spirit will very quickly dry on the job leaving behind a white flaky substance (napthalene flake). This is the 'key' to getting the paint to stick to the brass. Leave in the sun to dry out for a few minutes before applying the undercoat and finish coats, of course a quality paint is recommended and oh, yes, use a spray gun and not a brush! If you don't have the luxury of an air compressor or spray gun, someone in the club does.

A 5" gauge NSWGR 422 class Diesel Outline Locomotive

Part 22 of the construction of a battery electric locomotive

Barry Glover describes the fabrication and fitting of some optional extras

Drawings for publication by Neil Graham and photos by Barry Glover and Neil Graham

We are nearing the end of the project and as anyone who has built a working model knows, there are always some final parts which are left until the end. Sometimes this delay is for convenience; sometimes it is because the constructor cannot visualise the method needed, or how it will look, until the particular stage of construction is reached. These parts are optional extras, and while not strictly necessary, do enhance the final appearance of the locomotive.

Cab steps

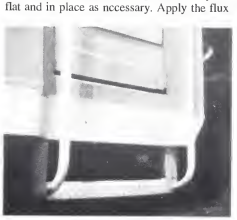
The cab steps are one item which could not be located until after the exact location of the cab door position was finalised. The centring location of the steps is now possible. The cab steps are made of brass angle screwed up to the locomotive frame with countersunk screws, then suitably bogged up to hide the screw heads.

Cut and square off the ends of eight pieces of 6 x 6 x 1.5mm brass angle, all 26mm long. If you haven't any 6mm angle, mill some larger stock down to size. Round off the outside corners along the length of all the angles to represent a folded steel angle. Cut four pieces of 8 x 3mm thick brass flat stock 62mm long.

Mill the eight pieces 26mm long as per Figure 61. This will allow the completed steps to sit flush with the outside of the locomotive frame. Put these pieces aside.

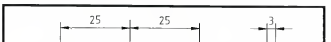
With a slab of aluminium (preferred), make up a silver soldering jig as shown in Figure 62. The nominal depth of the slots in the jig are 4.5mm.

Put the pieces for the steps in the jig, so that they fit neatly and with the downward leg of the angle just touching the bottom of the recess. Make up small wedges to hold parts flat and in place as necessary. Apply the flux then silver solder all the joints, pickle them and then clean up when finished. Do the same for the other three step assemblies.



Installing the steps

Now, concentrating on one set of steps only, offer the steps up to the inside of the locomotive frame. Note the outside face should be flush with the outside of the frame. Look out for the inside welds which hold the frame together. The odd one may foul the steps where they offer on the inside and so will need to be ground away. The 8mm wide top piece of the steps can also be cut back to 6mm. This is a bit tricky, but I got around it by purchasing a 25mm diameter x 60mm long mounted-point (grinding bit) with a 6mm shank from a general engineers supplier. I used it in a high speed pistol drill.



At this point, you may notice that the cab door handrails may be just fouling the steps. You will need to file the inside face of the handrail so that when the cab is slid on and off the loco, the handrail sits just against the steps.

With the locomotive cabs in place, project lines down across the frame from the inside edges of the east door recess. The distances between the lines should be about 74mm. Mark off the vertical centre line. Scribe a horizontal some 3.5mm up from the bottom edge of the frame across the door width. Centre pop the intersection of the vertical centre line and the just scribed centre line. Mark 25mm each side of the centre and centre pop. Drill all three holes to 1.5mm. Clamp the step in position, spot through and drill through the steps. Tap the steps to M2. Open out the frame holes to 2.5mm. Countersink the holes so that the heads of the M2 countersunk screws sit at least flush. Fasten the steps.

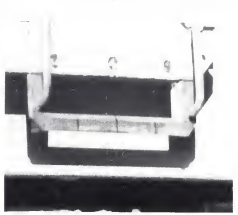
Fabricate and fit the other three sets of steps to their locations and screw them up permanently. Bog up the screw heads with an epoxy filler such as Epifiller® and wait a couple of days. File the bogged areas flush. It should now appear that the steps are welded in position. That's the trouble with all this modern stuff, they stick it all together with that extra strong "electric glue". Still, it beats riveting — or does it?

Left: 42216 showing the cab steps and location of the handrails.
***Right:** The 422 model, with the cab steps installed, before the screw heads have been bogged over and hidden with filler.*

Air hoses

Hung from each end of the 422 class locomotives are seven air hoses. They supply air for locomotive brakes (four), air receivers (two) and train brake line (one). Associated with the air hoses are dummy couplings, chains and securing eyebolts. There are also three different sizes of shut-off cocks and three different styles of gladhands.

Now if we had to fabricate all this lot with any sort of accuracy, it would probably take as long as building the rest of the loco! There are some 56 components in all! Fortunately, a kit of lost wax castings is being made available for all of these prominent items. The kit



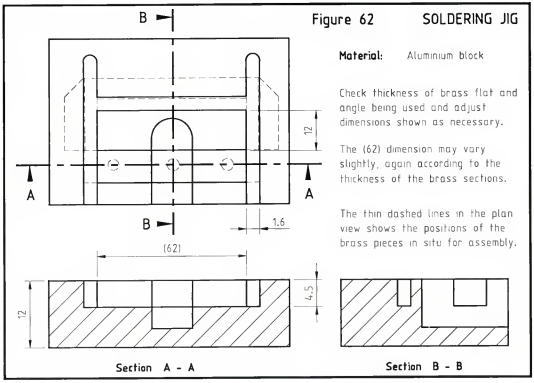


Figure 62 SOLDERING JIG

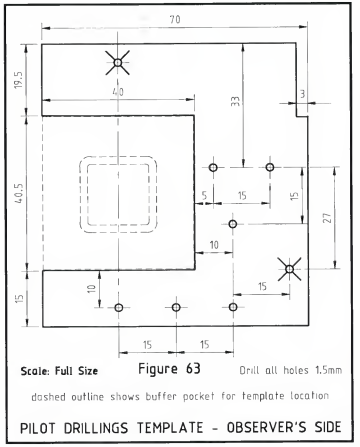


Figure 63

includes all components needed to complete the miriad hose connections on the front end of the locomotive. These are being marketed by Scobie and Glover Sheetmetal Pty Ltd, who advertise regularly in this magazine. The kit is complete with shut-off cocks, handles, chains, wire, hoses and couplings. Before you start pulling pieces out of the plastic bag, it is best to get an idea of their location and orientation. Look at the photos to get the general idea.

Location template

First job is to remove the buffer plates from both ends of the locomotive. Then make up a template as shown in Figure 63. It can be made out of any scrap piece of flat plate. It is only going to be used four times. Note that the template has drillings for eight holes.

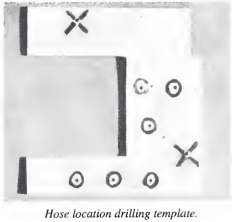
Looking at the template in Figure 63 and the adjacent photo, which is for the LH side when facing the front of the loco: note that two of the holes have a large X on them. These are not spotted nor drilled in through the apron, so in fact the left hand side has only six holes drilled. When you turn the template over and sit it on the right hand side of the apron plate, there are eight holes to drill: see Figure 64. Drill all the 1.5mm holes right through the apron plate. Now we open out all the holes to the correct sizes.

Referring to Figure 64, open the vacuum pipe fitting hole to 8.5mm. Open the independent brake holes out to 2.0mm. Open the main reservoir holes to 2.5mm, train brake hole to 3.0mm and the bottom three holes to 2.0mm. Open out the drilled holes on the other side similarly.

Train brakes

Before proceeding any further, we will take a diversion back to the train brakes. Our original intention was to run the train brake connections out through the front of the cab. We have since realised that this could not be done satisfactorily without spoiling the look of the cab front. So we have had a re-think.

We originally installed a piece of copper tube for the train brake line from the vacuum compressor to the loco ends. This has served its purpose while we tested the system. It can now be removed from the loco.



Hose location drilling template.

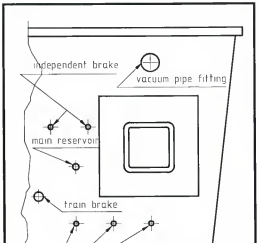


Figure 64

The template in position over the buffer pocket.

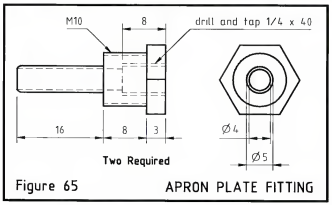


Figure 65 APRON PLATE FITTING

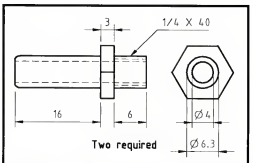


Figure 66 VACUUM HOSE FITTING

You will notice that — when facing the apron — there is a hole virtually above the RH buffer stock. Refer to Figure 64. This can be tapped to M10. Do both ends of the loco — it's best to do this now rather than after the cocks and hoses are fitted.

Make up two apron plate fittings as in Figure 65. At the same time it is a good idea to machine up two vacuum hose fittings as in Figure 66 and make up one pipe plug as in Figure 68, remembering to drill through the No.78 drill vacuum bleed hole. Finally make a a T-piece (Figure 67) from 3/16" diameter copper pipe. Silver solder a copper stub pipe to the centre of the 50mm piece then drill down through the just soldered stub into the main pipe section.

Screw in the apron plate fittings at each end: from the outside. Screw in one vacuum hose fitting on one end and screw in the pipe plug at the other end of the loco. The second vacuum hose fitting is needed when your loco is double headed, i.e. both locos with drivers, thus the brake pipe will act as a through pipe only.

Purchase 3m of thick-wall 4.8mm (3/16") inside diameter plastic tubing from your local automotive supplier and run it the full length of the loco, keeping it above the frame in the centre body section — between the cab bulkheads — and running below the frame for a push fit over the apron plate fitting internal nipple. Offer the other end of the hose to the fitting at the other end of the loco, then cut off the excess hose. Push the end on to the apron plate fitting nipple. Now at a suitable place near the vacuum compressor end of the loco, cut the tubing and insert the T-piece.

From the T-piece, run the remaining offcut of tubing back to the suction side of the vacuum compressor. This completes the train brakes.

Making airline fittings

Before we fit the cocks to the locomotive we must observe that on the full size they are supported to the apron plate by small rectangular plates which are welded to the apron. Small U-bolts in turn fasten the air line cocks to the plate. In our instance we will solder the rectangular plate to the air cock line. We will forego the tiny U-bolts as they are too fiddly and — unless you wish to view your loco while standing on your head — they will be out of sight in any case!

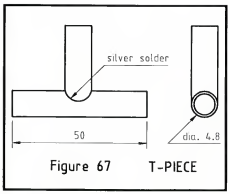


Figure 67 T-PIECE

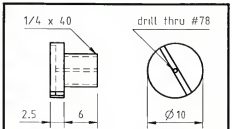


Figure 68 PIPE PLUG

From a small sheet of 0.55mm brass, cut eight pieces to the smaller size as shown in Figure 72. From the same brass, cut six pieces to the larger size shown. Remember to put small radii on the corners: just round them off by hand. Polish the tarnish off one side of the pieces, then flux and tin with soft solder.

Now get hold of the shut-off cocks, snip off the daggy end, where it was attached to the casting sprue, and clean off any sight of flash. Flux and tin the stems of the valves, where they will be accepting the fixing plates. Then tin the little shaft extension at the top of the valve bonnet. Now before we go any further, check out Figure 71 to get the orientation of the shut-off cocks right for the closed position and the position of the fixing plates for all except the train brake cocks, i.e. the largest two. The train brake cocks are fitted to the

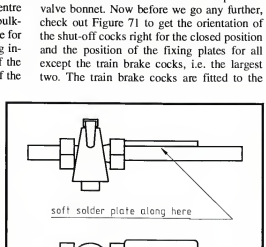
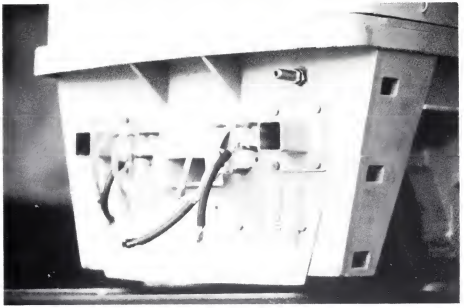
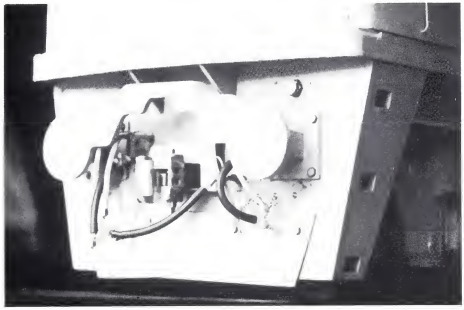


Figure 71 ORIENTATION OF FIXING PLATES TO AIR SHUT-OFF COCKS

The hoses and fittings for one end. The air cocks have already had the mounting plates soldered to them. Heaviest hose on the right is for the train brake line.



All hoses, dummy couplings and chains fitted to the locomotive. On this end the buffer plate has been removed to facilitate the fitting of these items. Note the vacuum hose fitting above the buffer pocket on the driver's side. The Observer's side hoses have been hung up.



The other end of the locomotive. Buffer plate and coupler have been re-fitted. The vacuum pipe plug has been fitted and the hoses hung up on the driver's side.

loco such that when you are facing them in position, the handle will be fitted on the right and the hose slip-on stub extension faces down and slightly towards the coupler pocket. When the handle is fitted, it is fitted in the vertical (i.e. shut-off) position.

Clean up the twelve smaller handles by rounding off the ends of the eight smallest and filing off the casting sprue on the remainder. Then tin the middle of the handle on the under side. Select the first valve, handle and fixing plate you wish to assemble. Lightly press the valve handle in position on the valve. Next get the tiny gas soldering gear out, apply heat to the handle centre/valve top and apply just the tiniest dabs of solder to the top — I used the same 1mm Savbit solder as used on the electronics. Next, locate and hold the relevant fixing plate to the cock stem and solder it in position. Note that the eight narrow plates go with the eight small cocks: for the independent brakes. The wider six go with the four larger (main reservoir) and two large (train brake) cocks. Having completed one, there are now another eleven small assemblies to solder together.

Referring to the adjacent photos of our locomotive and the photo on the next page of the prototype, re-check the orientation of the mounting plate and the handle position (i.e. vertical) for the train brake air cocks and then proceed to solder the bits on to both of them.

Fitting up

The next job is to fit the cocks to the locomotive apron. The first thing I did was to accurately measure the diameter of the valve stems with a micrometer. I selected a number drill to the nearest size to the stems (to give a clearance hole). Three size drills are needed. Ease the holes in the apron out to the correct size for the cock that will be fitted. After a test push fit, put a dab of Superglue on the stem then push the valve home into position on the apron. The fixing plates should sit right up against the apron. Follow the same method for all the cocks.

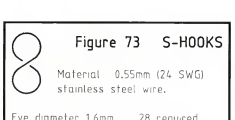
The dummy coupling chains

There are six holes remaining at each end of the locomotive apron plate. These hold the eyebolts and all the chains for the dummy couplings. Size one eyebolt stem with the micrometer, then out with the next biggest number drill and open out the holes (twelve in all). Gently slide the twelve eyebolts in position in the holes — just to make sure they are a neat fit — but do not glue them in just yet.

The S-hooks

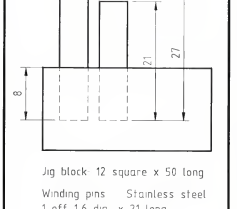
Probably the most tedious job connected with these fittings, is the making of the S-hooks for attaching the chain to the dummy couplings and eyebolts.

Make up a little winding jig as per Figure 74. Then wind some 0.55mm (24 SWG) stainless steel wire around in a figure-of-eight shape. Use a glove to do this job as the wire must be wound tightly around each pin. When you have six or so wound on, remove the wound stack from the pins and, with your smallest side cutters, snip them off the stack,



cutting as shown in Figure 73. Leave two full figure-of-eights remaining. Slide them back on the pins and then repeat the process. Make at least 28 of these little devils (best to have a couple of spares) as they will all be needed.

Chain assemblies



Now fit 14 of the S-hooks to the dummy hose connections. Cut 12 lengths of chain 8 links long. Cut two pieces 10 links long. Fit the eight-link chains to the 12 smaller dummies, and fit the 10 link chains to the largest two dummies. For the 12 smallest chains, attach them to 12 chain eyes. Now grab any one of the chain assemblies and fit one of the long chains to the same eye. Now do the same to one other short and long chains. Now you should have two assemblies with a long and short chain on the same eye and the remaining ten should have a single shorter chain and dummies. Now go around all the chain assemblies and carefully close up the S- hooks gaps with your jewellers pliers so that the chains and gadgets don't come apart.

Referring back to Figure 64 and looking at the chain eye locations, the two shorter chain and eye assemblies belong to the two locations directly under the buffer pocket plate. The two chains plus eye assembly belong in the hole closest to the train brake location. The other side of the locomotive has three single chain assemblies located in the three holes provided.The other end of the locomotive is treated in the same manner. Just fit the chain eyes in the holes. Do not glue them in, as they need to be removed before the locomotive is painted.

The lower front of a 422 class locomotive (sans buffers). In particular note the orientation of the shut-off cock for the train brake pipe, just to the right of and closest to the coupler.

The hoses

Cut all the hoses in half and fit them to the appropriate shut-off cock. To get them to look right, fit the independent brake and air receiver hoses so that they droop down rather than stick out. Just turn them on the cock stub piece until they droop the most. However, when you fit the train brake hose, turn it on the cock stub piece so it arches out and to the centreline of the loco when let go. Finally fit all the gladhands to their respective pipes. They sit with their rounded backs facing the right and their joining dogs to the left. Their weight should make the air hoses hang down further. The train brake hose should look as if it is trying to shake hands with the next loco or wagon.

Now connect up all the dummy connectors to the hoses. If the dummy is a little bit loose when connected to the gladhands, tighten up by very gently squeezing the small tag underneath. Look at the photographs in this article and then look at the way your hoses sit compared to the prototype. Some slight adjustment of chain and hose length may be necessary. However, on the full sized locomotives, most (if not all) of the time the hoses are just left hanging. The choice is yours.

Bogie steps

The bogie steps are prominent items which are located centrally below the cab doorway. Refer to Figure 76 and you will see that they are awkward shaped things, being attached by three stays to the bogie frame. The inside (ie. between the first and second axle) stay is in a rather difficult position to access the bogie to drill and tap the holding bolts. In fact we found the location impossible to tap and we were happy just to drill the holes 10BA clearance and just Loctite® the screws in. More on that later.

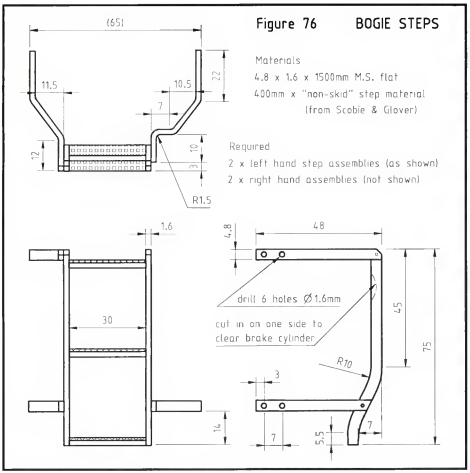
The steps also have very prominent tread plates on them, which appear to be a series of cube blocks stuck along a plate! These cube blocks are ½" square. With the several layers of paint and accumulated grime it was difficult to tell whether they were fabricated or cast in. The easy way was taken and a pattern was made and the steps were cast by the lost wax process. Strips of this cast material are available from Scobie & Glover. However, they can be made with a lot of milling or filing.

Preparing components

There are four step assemblies to be made. Figure 76 shows the left hand end steps. However, before we start we need to make a small bending jig. It is simply made from a piece of 25 x 12mm flat bar 100mm long. Mount this piece of bar on suitable parallels in the milling machine vice on the mill table. With a sharp 4.8mm (3⁄16") cutter, pick up the surface of the block, then centre it clear of the longitudinal axis of the bar, wind the table up 1.5mm and run a cut along the bar for the full length. Remove it from the vice, clean it up and put to one side.

You will now require some 1.6 x 4.8mm strip to make the stays. For the whole job you will need eight pieces approximately 90mm long and 12 pieces approximately 65mm long. You may be able to purchase some strip from your local model engineering supplier, or your local sheet metal supplier may shear a strip off a sheet — or you can simply cut some strip from a sheet offcut. Just make sure it fits in the slot you have cut in your little bending jig.

On a clean piece of flat plate, accurately mark out the shape of the step side leg. Make up a template out of thin sheet. Together,



these will be your check on the legs' length and profile when bending.

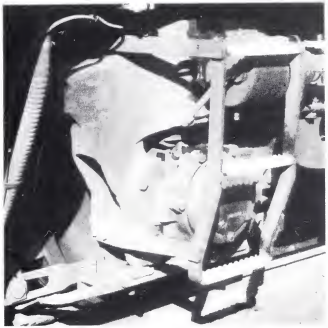
Referring to Figure 76, set the first 90mm piece in the grooved jig then in turn in the vice then draw the first offset. If the strip wants to slip or buckle, hold it in the groove with a toolmakers clamp. Release and remove any sign of buckling with a small hammer on a flat block.

Reverse the strip and position it in the groove to the correct distance and bend as before. Flatten as necessary and then lay the strip over the drawn template.

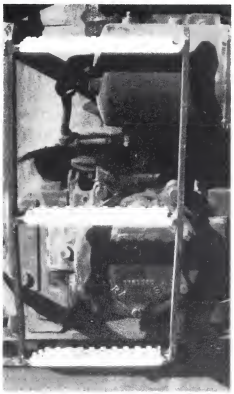
If you are satisfied with the first one, use a similar procedure to do the remaining seven legs to the dimensions and template.

Again, referring to Figure 76 and while you are in a bending mood, you may as well make up the stays. Using the figure to get your measurements, make two templates to represent the profile of the offsets at full size. Now before you bend the stays you need to drill a few holes in them: 1.2mm (3/64") holes near the end of each. These will be used later to rivet the stays to the step sides to hold them together while they are silver soldered on: just the one hole in each stay.

Now using the same method as before, bend all the legs to the correct profile. Trim to length at the free end then drill the pair of 1.6mm mounting holes in them.



The bogie steps on 42204 showing the securing method.



A closeup of the bogie steps on 42204. Note the unusual non-slip tread pattern and the tortuous shape of the inner (right hand) stay needed to secure it to the bogie frame.

The assembly jig

To assemble the steps, a jig is required to hold all the bits and pieces to enable them to be silver soldered together. I made the jig from a small block of aluminium (so any solder run would not stick to the jig). I suppose steel could be used, as long as you painted "liquid paper" on the areas where the job may stick. First thing to do is to machine the basic block with the 7mm step in it. Check this with

Just to show there are differences within the class, the treads on these steps are made from weldmesh! How does one make these in miniature form?

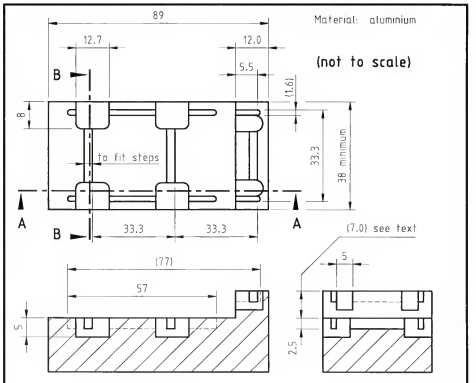


Figure 77 SOLDERING JIG FOR BOGIE STEPS

the offset in one of your pre-formed side legs.The short offset piece should just slide over the raised portion of the block.

With a 1.4mm (1/16") cutter, plenty of speed and a cutting lubricant, mill the four grooves 2.5mm deep to hold the side legs. Change to a 2.4mm (3/32") cutter and mill the slots to take the treaded steps. If you are using castings, check their thickness as they may vary slightly due to shrinkage.

Finally, change to a 5mm (approx. 3/16") cutter and mill out clearance grooves as shown around the joints. This will aid the application of local heat to the joint area and will give you several lever points under the joints to pop the steps out of the frame when complete. Clean up the burrs and make sure the side legs and treaded steps fit in neatly before removing the block from the mill table.

A bufferless 42220 showing the hoses (some tied up and some hanging), bogie steps (weldmesh type) and the cab steps.

Assembling the steps

Pre-drill the side legs in the locations for the stays with a 1.2mm (3/64") drill. Clean up all the legs, stays and tread sections.

Fit a leg in each groove in the soldering jig. Cut three step sections to length so they fit in the jig neatly between the side legs. Make sure they are the right way up. Apply a dab of silver solder flux to the six areas to be jointed, then, with a small flame and the CIG 245 silver solder at hand, silver solder the legs to the steps in all six places. When cool, pop the step frame out of the jig and pickle the flux off. Examine the step assembly and, if satisfied, repeat the process with the other three units.

Next we need to fix the stays to the step frame. Referring to Figure 76, pick out two left hand stays and one bottom right hand stay. Now rivet them in position on the step frame. Do this to one other step frame.

The ones just completed are the left hand end steps. The steps for the right hand end of the loco, when facing the side, are called the right handed steps. The differences are only in that the stays are swapped over so that the two similar steps are on the right and the more complex bottom stay is on the left. If this sounds a bit complex, then offer the left hand steps assembly up to the left hand end bogie and see the orientation of it all against the bogie frame, then offer a bare step frame up to the right hand bogie under the cab and you will soon see the relative positions required for the stays. Rivet the stays on to the two right handed steps.

Flux up the areas just riveted. Now with your itty-bitty oxy flame and just a spot of silver solder, do the trick at all the riveted joints. Pickle and clean up the four assemblies.

File all evidence of the rivet heads away. Clean up any blobs of silver solder, then file away any overhang on the bottom stays. Also, file the small bevel at the top of the steps.

Trial fit

The fitting of the step assemblies requires a bit of trial and error. The stays may require a little bit of re-shaping or bending. First two to fit are the ones under the driver's side door. These are the left hand ones as in Figure 76. When you offer one up, it should be slightly tight across the bottom two stays. Push it in so that the ladder sits vertical. You will see that it fouls the brake cylinder. Mark the spot where it fouls and scribe an arc across half the depth of the leg and file out a profile so that when the steps are offered up they sit neat into the cylinder. Do the other left hand step assembly the same and then do the pair which go under the observer's side door. Check that they are close to being directly under the cab steps. This position may vary slightly due to drive chain stretch as the drive system ages.

Permanent fit

To fit the steps permanently to the bogies, the bogies will need to be removed from the locomotive. Before removing, mark the steps with their bogie, take the steps away, then remove the bogies off the locomotive frame and re-fit the steps to the bogies.

You will notice that the top stay sits just

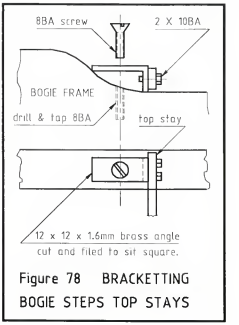
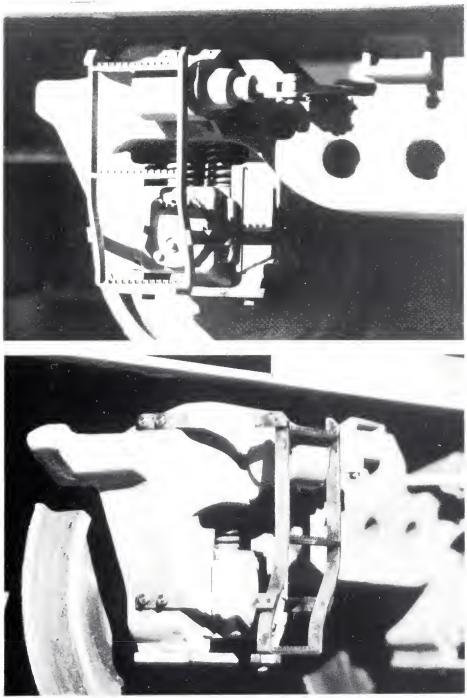


Figure 78 BRACKETTING BOGIE STEPS TOP STAYS



The two photos above show the completed bogie steps assembly on our locomotive. These are the left hand end steps as drawn and described.

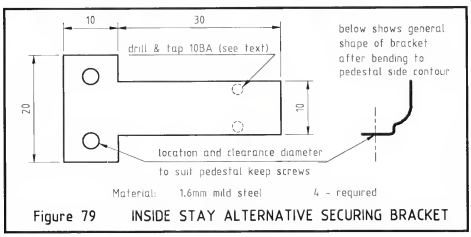


Figure 79 INSIDE STAY ALTERNATIVE SECURING BRACKET

across the top of the bogie frame with nowhere to fasten it. You will need to make up four brackets as shown in Figure 78. After you have made them up, drill the 8BA clearance holes through the top of the angle and countersink the top for the screws to be used. Place one angle bracket in position and spot through the vertical hole. Drill and tap 8BA: about 5mm deep tapping is enough. Fix the bracket to the frame with a screw. Spot through the two side stay mounting holes then drill and tap 10BA. Fasten the top stay to the bracket with 2 x 10BA hexagon headed set screws.

Spot through the bottom stays on the same side of the steps (this is the "outside" of the bogie) into the bogie. Drill and tap 10BA. Tapping 5mm deep should be enough. Screw the bottom stay to the bogie frame.

Now the tricky bit. The bottom inside stay is in a very awkward position to do much with. There are two ways to fasten it, the first method is the way we did it and the other is an idea only. If you have a small right angle drive-head drill you are lucky. If you haven't, then drilling in at a bit of and angle is your only recourse.

Since it will be impossible to tap into the frame here, we decided to drill a 10BA clearance hole into the bogie. Spot through the bottom side stay then drill into the bogie about 5mm. Insert a 10BA screw into it and then drill the next door hole the same. Put a dab of Loctite® 406 (Superglue) on to a 10BA x 6mm long hexagon headed screw and push it home. Remove the adjacent screw and put a dab of the magic glue on to it and then push it home.

The alternative suggestion is as follows. Remove the bogie steps from the bogie frame. From a piece of scrap 1.6mm mild steel sheet make up a T-shaped section as in Figure 79. Drill two clearance holes through the T top to the pitch of the axlebox keep bolts. Undo the keep bolts and fasten the T-piece to the keep with the leg towards the middle wheel of the bogie. Bend the leg up as close as possible to the contour of the bogie, so that it rests against the pedestal. This will be your inner bottom stay holding bracket. Put the bogie steps back on; the bottom inside stay will need to be reset out by 1.6mm. Mark through to the new bracket for the hole centres. Mark the excess bracket length above the stay. Remove the bracket and drill and tap the marked holes to 10BA. Cut off the excess length. Re-install the brackets, then the steps. Fasten the steps to the inside bottom bracket with 10BA x 3mm long hexagon headed set screws.

Do the same procedure to the other three sets of steps. Install the bogies back on the locomotive and go and have a drive.

In the next part we will conclude the super detailing.

To be continued...

Letter Box

Simple marine engine errata

Sir,

With regard to my "A Simple Marine Steam Engine" story on page 13 of the September-October issue of AME. I must congratulate your draughtsman, Peter Manning, on his presentation. It is of much higher standard than I could manage, and was made from a sketch of sectional elevation, and an end-on elevation.

There is however, a fault in the drawing of the cylinder ports, in that the measurement of all ports, now shown close to the bottom end of the cylinder, should be 3/8" down, as measured from the *top* end.

If anyone has followed this sketch, without noticing the fault, it wouldn't be hard to fix by plugging the unwanted holes and re-drill the holes the correct distance from the top.

The engine could not work with the port dimensions as shown, but it would work if the parts were made to suit the published general arrangement on page 13.

Normally I make the cylinder head last, with the spigot part made long enough to almost touch the piston at the top dead centre. If this is done, obviously the steam port would be closed off, so a samll flat is filed off the end of the head, or top of the piston, to allow the steam to flow.

I recommend a total compression ratio about 15:1, but it would work okay on 1/16" clearance as shown in the text.

Two other minor corrections would be obvious to experienced builders but might cause trouble for new modellers. One is in respect of eccentric "throw" shown as 3/32" this is not wrong, depending on which school you went to, but actually refers to the centre displacement. What we really want is an eccentric stroke about 3/16". The text is correct. It says "drill the shaft hole as close as you can to edge of 3/8" blank."

Where the text in the last paragraph on page 14 says "...shouldcred down to 7/16" plus 0.005" interference." (for a press fit in the crank disc). It should read "down to 7/64" plus 0.005 for press fit in normally drilled 7/64" holes in disk." No shoulder is needed at all — if you have access to drills which will allow a press fit on the 1/8" shaft. It is fairly obvious that the little end of the con rod would need attention with a file to swing easily in the piston.

With the valve, I normally tap the top end of the valve with 1/8" BSW, with a clearance hole most of way through from the bottom end. It would be okay as shown, but the valve rod would need thread all the way down to the clevis.

That's the end of the nit-picking. Congratulations on the mag in general.

If anyone wants a photocopy of my original sketch, which is double-size, I can send it at no cost, or if anyone makes a good effort at making engine, and is not successful, I may be able to correct it at no cost. I do not wish to build any engines for sale, but will help any builder if I can.

The engines have varied widely in appearance, from "open column", as shown, to "A-frame" type, depending on personal preference, and available small bits of metal.

11 engines have been made in my workshop over last year or so, all by "non-trades" people, and all worked straight off the board. Depending on intended use, and the time spent on construction, there was a wide spread of speed, power, efficiency and projected life span.

One was made as a desk ornament, very slack, and almost no lap, but it blows over at about 500 rpm on one good deep breath.

I don't use drawings, in accepted form, though I often do "partly mobile" sketches, as large as possible (often four feet long) of such detail as valve gear, to accuratcly determine clearances and develop accurate timing diagrams.

I have often been asked to assist in making model marine propellors. There seems to be an ample supply of commercial props, for the 10,000 rev/min-plus brigade, but little for scale-speed work. I now do my propellor bosses with a slitting saw and universal index head, but I used to do them with a hacksaw and file! If you think there could be any interest, I would try to do an article on doing it the hard way. In any case I'll do an article on matching electric motors and props for scale type ships, if I can get it sensible without drawings.

Bill Carter
NSW

More on marine burners

Sir,

I've been enjoying your magazine for about two years, especially the balance between marine steam and the 422 diesel articles.

I'm a model boat man with interests in the above, I don't think that I have the time yet to build a steam loco, but I'm looking very hard at the 422, as no boiler and my five-year-old could drive it under supervision.

Enjoyed the marine steam by Mr Jack Henshall, obviously a lot of experience has gone into it and a great reference for boaties like me who have yet to build a boiler.

But, could he be coaxed to provide a few more drawings on burners, especially the critical measurements of burner to boiler, as he mentioned in one of the two articles.

A friend of mine has done a simple boiler fired by a metho burner similar to Jack's which is stuffed with pipe cleaners and works A1.

I'm in the process of drawing up a vertical boiler for marine use, fired by gas to go through certification, as it is my first boiler, only 4" dia. x 8" overall height.

But as I'm a wool farmer and it's heading into my "Silly Season", I doubt that I will get very far this year.

Bill Stafford
VIC

Dual measurements

Sir,

I find your magazine very interesting, although there are not many construction articles in it. I am building a 3½" gauge *Rob Roy*. All the wagons in your magazine are in 5" gauge. Would it be possible to put measurements for both 3½" and 5" gauge on the drawings? I am sure I am not the only model maker in 3½" gauge that would be happy with it.

H. Fuller
VIC

I am very pleased that 3½" gauge is still being modelled! However, dual dimensions often lead to difficulties during the conversion, especially if it is rounded off. Also the extra numbers clutter a drawing making it harder to read. You would be better converting the measurements to your needs and checking for fit as you go. For example, with the S wagon story in issue59, multiply each dimension by 0.7 and it should work out okay in 3½" g... bmc

No 422!

Sir,

How refreshing it was to pick up the AME without five pages of 422! Issue No. 62 was very good despite the missing diesel article.

R. Phillips
QLD

Letterbox Contributions

Contributions of letters by mail to: PO Box 136, Robertson, NSW, 2577 or fax to: (02) 646 1362 are very welcome.

As far as possible, AME is an open forum for all members of our hobby. Therefore, all expressions of fact or opinion — as long as they are not libellous — will be considered for publication.

Please **type or clearly print** your letters, as script is often difficult for the typist to interpret.

News Desk

Compiled by Brian Carter

Compliments of the season to one and all! I hope Santa is kind to you and leaves a shiny new kit for you to build during the coming year. Maybe you might get one of the "Big Maroon" paintings advertised on the back of this issue, or something from Plough Book Sales, Camden Books or a video from Series 567 (they also have great steam or diesel Christmas cards). Maybe even AME Retail has something for the stocking. Please consider our advertisers when looking for that special Christmas gift.

A loss to model engineering

I was saddened to hear that Peter Bucknell had passed away on 7 September. I am sure that our readers join with the AME crew — their sympathy to Peter's wife and children. I had hope to have more information for the January issue.

AMRA Exhibition

It was good to see a model engineering contingent at the Australian Model Railway Association Exhibition, Liverpool, NSW, over the October long weekend. This year a combined effort from the Bankstown Live Steam Locomotive Society, Sydney Society of Model Engineers and the Western District Live Steamers. Members of these societies were kept busy with the thousands of admirers — who thought they came just to see electric trains!

Big versus Small debate

As far as AME is concerned, this debate is now closed. I am sure that any further discussion would be more fruitful at club level.

Oops!

Apologies to Doug Meller for misspelling his name. Doug kindly submitted an article on Counter-boring tools on page 45 in issue 62.

Contacting the AME office

Some readers have experienced difficulties while trying to contact the AME office. We were not amused at the person who resorted to profanities.

As a voluntary operation, AME is largely nocturnal, we all have day jobs. You can reach most of the crew and the (048) 85 1179 number between 7pm and 10pm.

I can be phoned at any time, the (02) 649 5301 number is basically for 7pm to 11pm Monday to Friday and anytime over the weekend. If you use the mobile 018 number you may get a message that the call will be diverted — don't hang up — AME pays for the diversion, you still pay for the standard call. Leave the phone ringing as long as you can, sometimes I'm in a noisy environment and the phone ring is hard to hear. If you can't get through, try the (02) 649 5301 number after 7pm.

If you encounter an answering machine on any crew number, you should leave your name and contact phone number on the machine. Most messages are responded to within 24 hours. If you don't leave contact details, then you may encounter a long wait.

Information super railway

While on the subject of communication, a few readers have taken advantage of my email number that I mentioned in the last issue. This could be an interesting exercise! Newsgroups of interest to model engineers are now available from a number of addresses on the Internet. I won't go into detail now but a few of the interesting one's are:

- http://www.bendigo.net.au/~jstein/livestm .html
- http://www.hitech.net.au/~jhovel/bsme.htm
- http://sonic.apana.org.au/SteamAndEngine/se.html
- aus.rail.models
- rec.crafts.metalworking

After I've explored all these areas I'll let you know what they are all about.

Found

A superb hand-built brass-bodied/painted marker lamp, UK style, 5" gauge, was found at the Canberra Invitation Run. If you think it's yours, contact AME for collection details.

New club

A recent addition to the model engineering scene is a club at Grandchester, Queensland. I haven't noted this in the Club Roundup because we have no further news. Maybe a member of this club could send us some information?

Believe it or not!

Speaking of Queensland. The previous issue of AME's Club Roundup mentioned a track in the Rockhampton area boasting 8¼ miles of 7¼" gauge track. A reader tried to find out more about it, but nobody in Rockhampton had heard of it! AME then confirmed the story with the source after it was implied that we were reporting false information. Be assured that the track does exist but it is on private property and it is intended to remain private.

SRA Birthday

Happy Birthday to the NSW State Rail Authority who celebrated 140 years of operation on 26 September last. We were treated to many steam excursions such as the return of 3801 on the Newcastle Flyer for three days. Even the vintage train headed by 1709 got a workout on 26 Sept, as it re-enacted the first train trip from Sydney to Parramatta. Many other old favourites were dusted off for the occasion!

O Gauge revival

I spent a pleasant day in October with about 70 other modellers at the first O gauge Modeller's Workshop. It was good to see several familiar faces of model engineers at the function, not to mention a lot of small gauge friends! Bob Gallagher of the Australian Model Railway Magazine was also present. It was good to share a common ground with other railway modellers. Model engineering covers a very wide area and from what I saw, O gauge would be the fuzzy border! Congratulations to the organising committee, I hope it's on again next year!

Simple marine steam engine errata

Some drawing errors were discovered in the story in issue 62 from page 13. See this issue's Letter Box for corrections.

AME Comment

See this issue's Comment about 1996 input. The subject? — Tell us how you enjoy model engineering as a hobby.

We remember

As this 50th anniversary year draws to a close, I thought I'd share a couple of snippets of model engineers' involvement in the war effort.

November 1938: *The Model Engineer in Australia and New Zealand*: the editor A. Mar Chalmers, writes: "As I write, the air is full of wars, armaments and rearmaments, mobilisations and defence plans... brings back to mind the excellent work done during the Great War by a band of British model engineers... under the title of AOV or Amateur Ordinance Volunteers."

Mid 1940s: *Model Engineer* echoes the Defence Service's urgent call for volunteers to maintain and repair scientific instruments of various types.

Model Engineer, 10 April 1941: A report of a £100 cheque for payment to the Lord Mayor of London's Bomb Victims' Fund. The cheque was sent by the Sydney Society of Model Engineers. The cheque was acknowledged by the Lord Mayor.

Model Engineer, 15 May 1941: A shortage of measuring tools lead to a New Zealand model engineer, Mr J. Miller of Timaru, donating a micrometer and vernier to the British Ministry of Supply.

Many model engineering activities were suspended as workshops were turned into munitions factories. In some cases model making was used as therapy for hospital patients recuperating from war injuries. For all the model engineers who gave their life for their country. We remember them...
Lest we forget.

Classifieds

Traditional English Traction Engines

- Drawings, castings, accessories for 3" to 6" scale. Complete boilers supplied with pressure certificate. Machining and gear cutting service available. Send £5.00 sterling (or alternately quote credit card number and date of expiry) for catalogue and price list to: Live Steam Models Unit 7, Old Hall Mills, Little Eaton, Derbyshire. DE21 5DN U.K. Phone: ISD+44 1332 830811 Fax: ISD+44 1332 830050

MICROCRAFT PRESENTS...

- VHS Instructional Videos from the USA (PAL)
  Basic metal lathe operation Vol 1 & 2,
  Basic milling machine operation,
  Greensand casting techniques (foundry) Vol 1 & 2 and
  CNC X-Y-Z using car alternators (car alternators used as inexpensive power stepper motors!) $49.95 each plus $6 P&H, includes printed notes and diagrams
  * Credit cards accepted * Call Bob for more details:
  MICROCRAFT, PO Box 514 Concord, NSW, 2137
  Phone (02) 744 5440

Workshop Tooling

- A-Z Letter drills HSS in stand $95
  1-60 Number drill set HSS in stand $105
  Four different small tapered reamers $25
  NEW slitting saws 2¾" x 1" bore, 0.014" to 0.187" many sizes $20 each or three for $50.
  LPR TOOLMAKERS (057) 84 1351. See display ad.

Copper tube & sheet, Brass section & sheet

- Now available at competitive prices. ***Mail Order Only*** Send two 45c stamps for price list to: A-Head of Steam, PO Box 3, Wamberal NSW 2260. Phone/fax: (043) 34 2538.
  Also see display ad in this issue.

BOILER — MANUFACTURER OF

- Custom made to suit your requirements, Wet-back — BRIGGS — Water-leg — to meet within AMBSC and DLI boiler codes.
  Ph: (08) 255 4378 Fax (08) 380 9695, PO Box 321 Virginia 5120

7¼" gauge Black 5 Locomotive For Sale

- 4-6-0 current DLJ certificate, copper boiler, steel tyres. Runs and steams well. $13000 Ph Gerardus (06) 2074011 (BH) after 30 Nov.

5" gauge C38 Locomotive Parts For Sale

- Castings, flame-cut frames, drawings, needle roller bearings for driving axles. $800. Ph Gerardus (06) 2074011 (BH) after 30 Nov.

3½" gauge American Pacific Freelance For Sale

- Offers invited for the above steam loco in full run order. The set includes a riding truck, current boiler cert. Ph Bill (049) 75 4212

7¼" gauge 0-6-0 Tank Loco For Sale

- *Paddington*, castings, drawings and laser-cut frames. Fully imported, untouched, very good cond. $600. John (03) 9870 5480.

12" gauge Locos and track For Sale

- Two steam locos, a 4-4-2 complete, and a 4-6-2 complete less cab and tender. Diesel chassis and motor only. 8 wheel sets with bearings. 100 ft dia. circle of 14lb rail, some extra 14lb rail and misc items. All items stored for 20 years. Wish to sell in one lot for $10500 ONO. For further info call John (02) 528 9316, (074) 94 1191 or 015 466 798.

Model Engineering Estate For Sale

- **Locomotives:** 5"g *Speedy*, castings only. 3½"g *Juliet*, rolling chassis, sundry castings and drawings. 3½"g LBSC *Betty*, 2-6-2 book and castings. 3½"g Riding truck, castings and drawings. 1¾"g Green Arrow 2-6-2, rolling chassis, parts and drawings.
  Magazines: English *Model Engineer* 1971 - 1995. *Model Engineers Workshop* 1991 - 1994. AME 1990 - 1994. Plus sundry parts and drawings, also 1 to 10 BA screws. Ph (08) 344 2701.

7¼" gauge Battery Electric Loco Wanted

- Suitable for park rides. Drawings or part-built preferred. Rolling stock also req'd. Call Graham (075) 539 6999.

5" gauge Track For Sale

- Oval with passing loop and three sidings, 35ft radius end curves. Includes 25 x 10ft straight sections (as new), 2 x LH points and 3 x RH points built to precision standard. Sell as complete lot $4000. Also 1 tonne of steel for track construction, price neg. Contact Neil on (048) 85 1179.

7¼" gauge Locomotive For Sale

- Denver and Rio Grande 2-8-0 class C19 Baldwin locomotive. Length 125"; height 33½"; width 29½". Bore 3¼"; stroke 4". Approx weight 1200lbs. Loco has never been steamed. Built to museum quality. Boiler government certified. Asking price by negotiation — realistic offers. Phone Raymond (066) 52 3283

Classified rates

- $3.50 per line as published (including heading). As a rough guide, count 58 characters per line (including spaces and punctuation). No limit to the number of words.

Subscribers Free Market conditions

- Non-commercial only, at the publisher's discretion.
- Maximum of twenty words, including your contact name, phone number or address.
- Posted, on special form provided. No faxes please.
- 5" gauge or larger locomotives (for sale) are not eligible.
- Only one entry per issue.

Subscribers Free Market

FOR SALE

Copper tube for sale: 1⅛" diameter, 0.065" wall thickness, 9ft 4½ins long. $60. phone John (047) 51 1360, after 8pm.

WANTED

Rolling stock book, Queensland Railways, 1982 or older. Phillip Cobden, Winkle 13, 21635, Jork, Germany. Ph ISD + 00 49 4162 8860

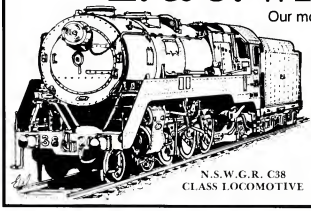
7¼" gauge steam loco suitable for fun park operation. Also rolling stock suitable for passenger hauling. Ph Dave (089) 27 7508.

7¼" gauge loco, steam look-a-like, petrol powered. Ph (066) 851 1322, Fax (066) 51571.

Parts and information for LF26 Albion truck on solid tyres. Ph Noel on (054) 29 6316.

Alchin 3" scale cylinder casting or loan of pattern. Des (085) 63 3729 PO Box 312, Tanunda, SA, 5352.

E. & J. WINTER present



N.S.W.G.R. C38
CLASS LOCOMOTIVE

Our most popular and best performing design in 5" gauge.

The Famous NSWGR C-38 class (4-6-2) Steam Locomotive.

1⅞" dia. cylinders and over 300lbs weight add up to an impressive locomotive, with an even more impressive performance, well proven by a number of very successful completed examples.

Available in both conventional and streamlined forms, the 27 or 28 sheets of fully detailed plans (as applicable) cost $163-70 or $169-80 per set respectively. A large and comprehensive casting set of 124 items is great value at $1288-00, plus many extras to assist builders.

If your aim is to move tonnage with a reliable locomotive design, then our 38 will be your choice.

For further details write, phone or fax. to:-

P.O. Box 126, WALLSEND NSW 2287

Phone & Fax. (049) 51-2002

AUSTRALIAN STEAM POWER

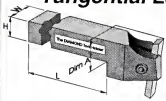
The Steam Enthusiast's Magazine

Subscriptions only A$24 for 6 issues p.a.
(add A$18 for overseas airmail)
Available from:

PO Box 208, BERRI, South Australia, 5343

THE DIAMOND TOOLS A WINNING COMBINATION!

Tangential Lathe Tool Holder



Price includes a DIAMOND grinding fixture plus H.S.S. tool bit & key (D size has Toolholder and Grinding Fixture only). Type A is for 3½" - 4½" centre height lathes. Type B is for lathes with about 150mm (6") centre height. This includes most Far Eastern lathes.

Thread Cutting Tool

Grinding Fixture

GUIDE TO CHOOSING A DIAMOND TOOL HOLDER

BEFORE ORDERING, measure the distance from the tool-rest landing to the lathe centre. This measurement is directly related to "Dim A" which is the minimum setting of the tool bit in the holder. Select the toolbit that suits your application.

TYPE	L.W.H.	Dim A	TOOLBIT SIZE	PRICE, each	POSTAGE
A8	77 x 12 x 11.5	8mm (5/16")	1/4" Square	$98	$5
A9.5	77 x 12 x 13	9.5mm (3/8")	1/4" Square	$98	$5
B16	77 x 14.3 x 15	16mm (5/8")	1/4" Square	$98	$5
D19	105 x 22 x 18	19mm (3/4")	5/16" Square	$148	$5

Parting Tool

NEW

Features: Simple to sharpen (end face only) Tool doesn't dig in. Suits most 150mm (6") C.H. lathes with cam lock chuck and reverse rotation. A parting tool is also available for screw on chucks.

Price: $78.00
Postage: $5.00

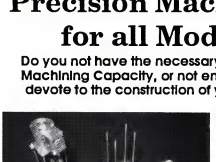
Write, Fax or Phone for details to:

D & P BURKE TOOLMAKERS

27 Woodstock Rd, Mount Waverley, 3149, Victoria
Phone (03) 807 6316 Fax (03) 807 9620
We accept: BANKCARD, VISA & MASTERCARD

Precision Machining for all Models

Do you not have the necessary skills, or the Machining Capacity, or not enough time to devote to the construction of your model?



We offer our services as specialists in precision Drilling, Milling, Turning and Grinding, and have the necessary machinery to do the work.

Send us your drawings and specifications for an obligation free and competitive Quotation. We are geared especially to cater for Model Engineering.

For further information:

John Podmore

P.O. Box 40, DAYLESFORD VIC 3460
Phone (053) 483-416 Fax. (053) 482-635

Interested in metalworking?

If your interest in metalworking extends beyond model engineering, grab a copy of

House & HOME

the practical magazine that includes welding, machining and other aspects of metalworking, as well as woodworking and building skills, in projects for the home.

Published every second month (Feb/Apr/Jun/Aug/Oct/Dec). Available from newsagents or by subscription ($40 for 12 issues, $22 for six) from Skills Publishing Pty Ltd, PMB 7, Rozelle, NSW 2039. Ph: (02) 810 6222. Contributed articles are invited -- ask for our Guide to Authors.

Plough Book Sales

A History of Aircraft Piston Engines, 244 pages $38.00
A. H. McDonald, Industrial Pioneer, 350 pages $30.00
Diesel's Engine Vol. I, From Conception to 1918 ..... $99.00
Old Marine Engines The World of the One-Lunger $49.50
Australian Steam Power — Bi-Monthly magazine..... $ 4.50
Guide for the Boiler Attendant's Certificate $18.95
History of the Great Dorset Steam Fair — Video 60min ... $43.00
New Catechism of the Steam Engine (1904) 437 pages $29.50
The Portable Steam Engine $39.00
Steam Engine Design (1896), 150 pages $19.00
Steam Engine Principles Their Application, ... $22.50
The Last Years of Mill Engine Building, 138 pages $37.00
The Victorian Steam Heritage Register, 200 pages $29.00
The Story of the Britannia Iron Works, Marshall $63.00
An Introduction to Stirling Engines, 80 pages $19.50
Practical Notes on Hot Air Engines..... $25.00
Stirling Cycle Engines, 122 pages $17.00
50 Perpetual Motions (1899), 30 pages ..... $ 7.50
507 Mechanical Movements (1893), 122 pages $15.00
Making Charcoal and Coke, 23 pages ..... $ 6.00
Practical Distiller (1910), 156 pages $17.00
Windmills & Wind Motors (1910), 78 pages $12.40
Building & Running of Steam Traction Engines Models ... $46.00
Building Simple Model Steam Engines by Tubal Cain $15.00
Building the Climax by Kozo Hiraoka, 224 pages $59.50
Building the Henly 'Junior' Steam Engine ..... $ 3.00
Building the Shay by Kozo Hiraoka, 194 pages $55.00
Building the Stuart Beam Engine $11.50
Building the Stuart No. 1 Engine $11.50
Gears For Small Mechanism by W.O. Davis $59.50
Machinery for Model Steamers, Boilers and Engines $12.50
Model Boilermaking by E. L. Pearce..... $13.00
Model Jet Reaction Turbines $16.00
Model Steam Turbines $13.50
Model Engine Construction (1894), 350 pages $28.00
Model Hit and Miss Engine 1⅛" bore 1½" Stroke $21.00
Model Locomotive Boilermaking by Alec F. Farmer $36.95
Model Petrol Engine by E.T. Westbury $35.00
Model Petrol Engines — Design & Construction $12.50
Model Stationary Engines, Their Design & Construction .. $14.50
Model Steamer Building, by Percival Marshall $12.50
The Model Steam Locomotive, 208 pages $34.95
Walschaerts Valve Gear by H. Greenly..... $13.00
So You Want to Build a Live Steam Locomotive $55.00
Steam and Stirling Engines You Can Build, 160 pages ... $60.00
Steam and Stirling Engines You Can Build Book 2 ..... $69.00
Timber Times Logging Modeling Magazine ..... $ 9.50
Twin Cylinder Horizontal Steam Engine plans ..... $ 3.00
Modern Locomotive Construction 1892, 657 pages..... $90.00
Valves & Valve Gears for Steam Locomotives $25.75
Model Engineer (assorted issues from 1928) ..... $ 3.00
Strictly I.C. Magazine (6 issue sub. $45)..... $ 9.00

Design/Build 200 Amp Welder, 30 pages ..... $ 8.00
How to Build a Solar Cell that Really works ..... $ 9.20
How to Run Three Phase Motors on Single Phase Power .. $ 5.75
Power Inverter Technology ..... $ 8.00
Advanced Machine Work (1925 workshop), 800 pages $44.00
Around Wilf's Workshop the Restorers' Handbook..... $25.00
Art of Coppersmithing A practical Treatise, 352 pages $39.00
Art of Engraving, 199 pages $20.50
Blacksmith Shop & Iron Forging, 96 pages $14.00
Brass Hints & Tips (Foundry), 16 pages ..... $ 5.75
Dies — Their Construction and Use (1917), 400 pages $28.00
Elementary Forge Practice, 288 pages $20.00
Forge Craft (1913), 175 pages $15.00
Foundry Manual (1958 US Navy publication), 300 pages .. $37.00
Gears and Gear Cutting, 136 pages..... $16.95
Grinding, Lapping & Honing, 78 pages $15.25
Handbook for Drillers (1925), 48 pages ..... $ 7.75
Handbook of Mechanical Design $39.00
Hardening, Tempering and Heat Treatment, 128 pages ... $16.95
Hardening Tempering & annealing $18.50
How to Build a Forge, 15 pages ..... $ 9.00
Indexing Tricks (1903 milling machine work) ..... $ 7.00
Ingenious Mechanisms for Designers Vol. 1, 536 pages.... $65.95
Lapping & Polishing by E.K. Hammond $12.50
Lathe and Planer Tools (1908), 40 pages ..... $ 5.75
Lil Bertha Electric Furnace, 67 pages $16.00
Machine Tool Reconditioning, 533 pages $91.50
Manual of Blacksmithing by John R. Smith (1902) $19.95
McGraw-Hill Machining and Metalworking Handbook... $145.00
Melting & Casting Aluminium (1925), 253 pages $18.50
Ornamental Turning by John Henry Evans, 344 pages.... $35.00
Practical Blacksmithing & Metalworking, 360 pages $39.95
Practical Lessons in Metal Turning & Screwcutting $24.50
Shapers by Emanuele Stieri (1942), 180 pages..... $17.50
The Beginner's Guide to Fitting by J.P. Law $20.15
The Beginners Guide to the Lathe by P. Marshall $15.25
The Care and Operation of a Lathe (1942), 105 pages $11.00
The Complete Handbook of Sand Casting by C.W. Ammen $32.95
The Machinist's Bedside Reader, Projects, hints, tips $33.00
The Machinist's Second Bedside Reader by Guy Lautard .. $39.95
The Machinist's Third Bedside Reader by Guy Lautard ... $49.95
The Metalcaster's Bible by C.W.Ammen, 434 pages $44.95
The Patten Maker's Assistant: Lathe Work $31.00
The Principle & Practice of Ornamental or Complex Turning . $47.50
The Tinsmith's Helper & Pattern Book, 120 pages $21.00
The Welder's Bible by Don Geary $62.95
Toolmaking 1935, 184 pages $18.50
Treatise on Milling and Milling Machines (1919) $25.50
Turning, Boring and Grinding (1920), 340 pages $23.00
Turning Lathes: A Guide to Turning, Screwcutting, 432 pp $39.00
Universal Milling Machines, 94 pages $11.00
Grimshaw on Saws, 202 pages..... $31.00

We handle many other modeling, railway and metalworking books from the UK and the USA for a complete catalogue of over 2000 titles please send $2 (Payment may be by postage stamps).
Allow 12-15 weeks delivery for some items.
Payment for orders by cheque or money order made out to:

Plough Book Sales
PO Box 14, Belmont, VIC, 3216
Phone (052) 66 1262

Postage and Handling Charges.

Order Value	Postage Charge
$0 - $10	$2.50
$10 - $20	$3.00
$20 - $50	$5.00
$50 - $150	$7.00
Over $150	Free

THE BIG MAROON

BEYER-GARRATT 1009
at Queensland Rail Workshops, Ipswich, March 1995
A limited edition print from a Queensland professional illustrator and artist can be

YOURS FOR ONLY $115

Martin Johncock is offering a limited run of 500 colour prints of his painting "The Big Maroon" These 900 x 600mm (overall size) prints are presented with a maroon and gold border on a black surround. Each print will be numbered and signed by the artist, and will be accompanied with a certificate of authenticity from Australian Railway Historical Society, Queensland Division.

Also on offer are two pencil studies
Only $40 each

Rods & Wheels of a Garratt

Pencil study 540 x 500

These were drawn in preparation of the major work and come complete with a black surround.

The original painting of "The Big Maroon" was rendered in designers Gouache. The colour print is printed on 270gsm Royal Saxony Embossed. The pencil study prints are printed on 216gsm Grandee White. Framing can be arranged at extra cost.

If the coupon has been clipped please phone: (STD 07 / ISD 617) 202 7575 to place your order.

A Garratt head on

Pencil study 650 x 500

The Big Maroon Offer

6 Banyan Street, Bellbowrie, Qld, 4070
PO Box 115, Station Road, Indooroopilly, Qld, 4069
Phone/Fax: (STD 07 / ISD 617) 202 7575
Please find my cheque/money order for:
$_____
or please debit my ☐Bankcard ☐Mastercard ☐Visa

_____

This offer includes postage and packaging
Please allow about 30 days for delivery

Name_____
Address_____
_____Postcode_____
Country_____
Signature_____
Phone: ( )_____
Credit Card Expiry Date:_____